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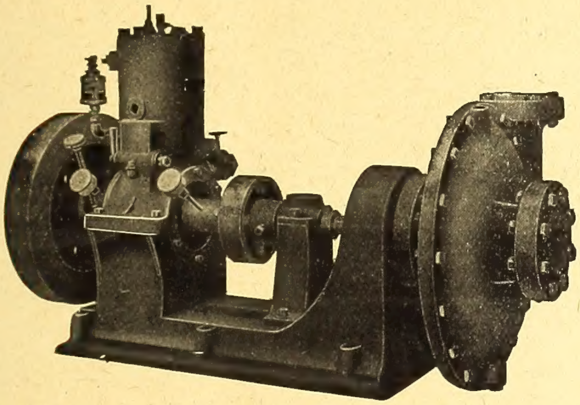
Vol. 29 Toronto, May 5, 1915 No. 18

ESTABLISHED 1886

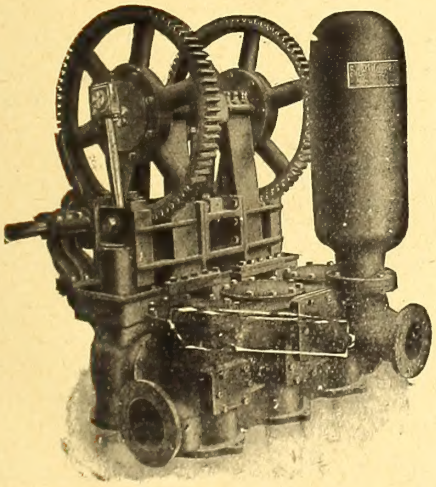
Contract Record and Engineering Review

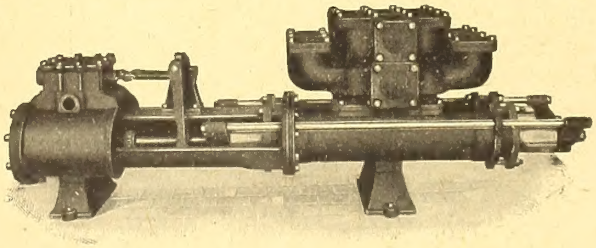
Specialists in Pumps

FOR many years we have been devoting our best energies to this particular line, which enables us to offer you perfected designs for the particular service required.



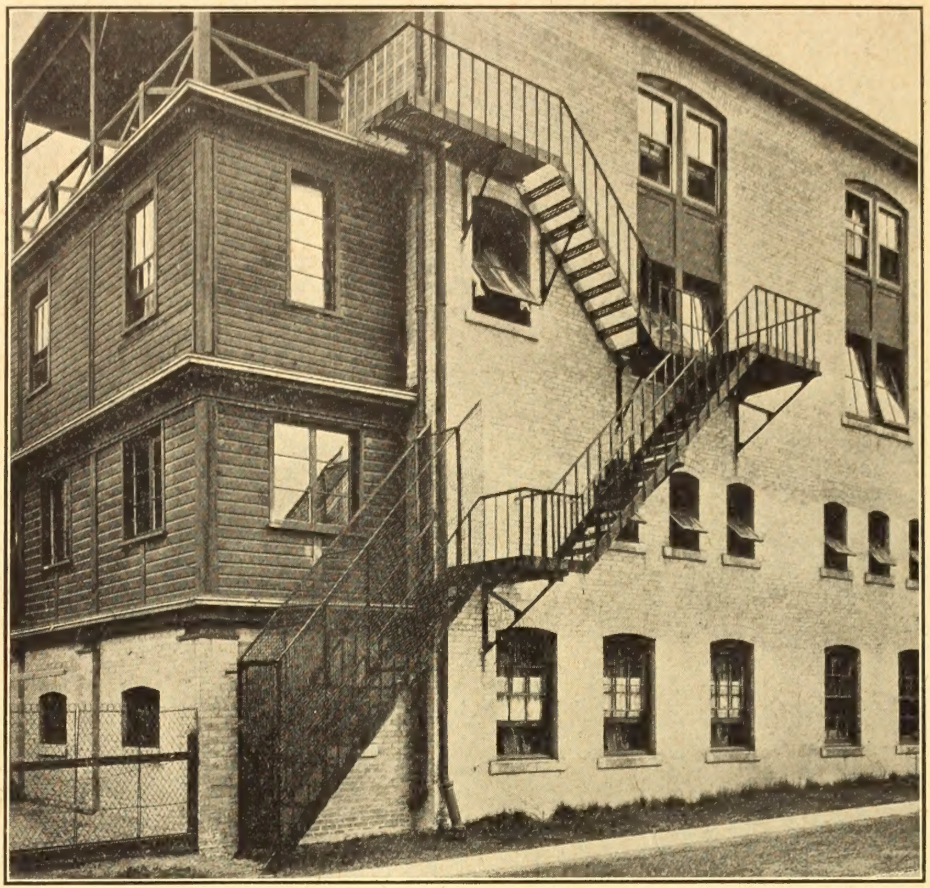
You require the services of a specialist in order to obtain the best value for your money.





The Smart-Turner Machine Co.
Limited
Hamilton, Canada

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6



Manufacturers of

Iron Fire Escapes

Marquise, Covered Ways, Balconies, Gates and Railings, Collapsible Gates and Fire Door Fittings

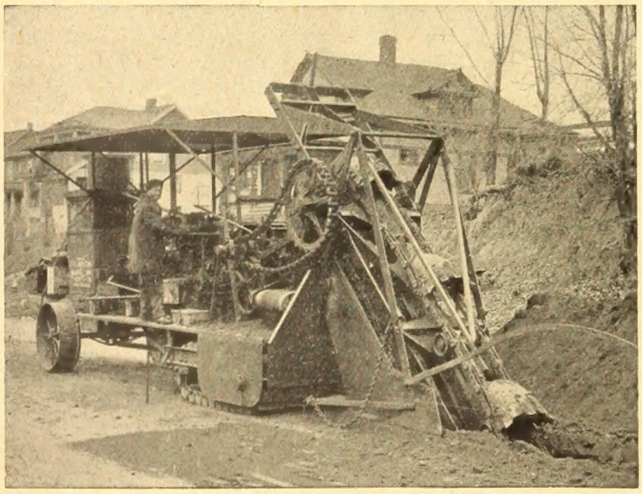
Aikenhead Architectural Metal Works

364-370 Richmond St. W.,
TORONTO, ONT.

1000 Feet a Day at a Total Cost of 1 1/6 Cents a Foot!

That's the Kind of Cost Records accomplished by the

AUSTIN Trench Excavator



Those figures may seem small but after you note what they cover they may impress you as even more remarkable still.

Here are the expense items on which the net total of 1 1/6 cents a foot was based:

Cost of operator, assistant, board bill of operator, some teaming, gasolene and lubricants.

The work was accomplished at Aurora, Illinois, U.S.A., under the supervision of L. H. Johnson, superintendent of distribution, the Western United Gas & Electric Company of Aurora.

Some of Mr. Johnson's daily reports follow:

May 10th ... ... 1450 ft., total cost per foot $0.0078
May 12th ... ... 1430 ft., total cost $0.0093
May 17th ... ... 1250 ft., total cost $0.009
May 24th ... ... 1257 ft., total cost $0.0091

The above are merely characteristic of the economy achievements of Austin Trenching Machines.

It will pay you to get the details which explain the advantages of the Austin Machine

Write to our Canadian Representatives—the one nearest you

Lecky & Collis, Limited, 49 Beaver Hall Hill, MONTREAL; 43 Scott St., TORONTO, or P.O. Box 611, NAPANEE, ONT.
Canadian Equipment & Supply Co., CALGARY and EDMONTON. Dominion Equipment & Supply Co., WINNIPEG, MAN.

F. C. AUSTIN DRAINAGE EXCAVATOR CO. Railway Exchange, CHICAGO, U.S.A.
Agents Wanted in Open Territory

28 "Service" Branches
Throughout Canada

**Canadian Consolidated
Rubber Company, Limited**
Montreal, P. Q.

"GET THE HABIT"

Buy Rubber Goods

(Tires, Hose, Belting, Packing, Etc.)

Made In Canada

GET ANOTHER HABIT

Buy Them From Us

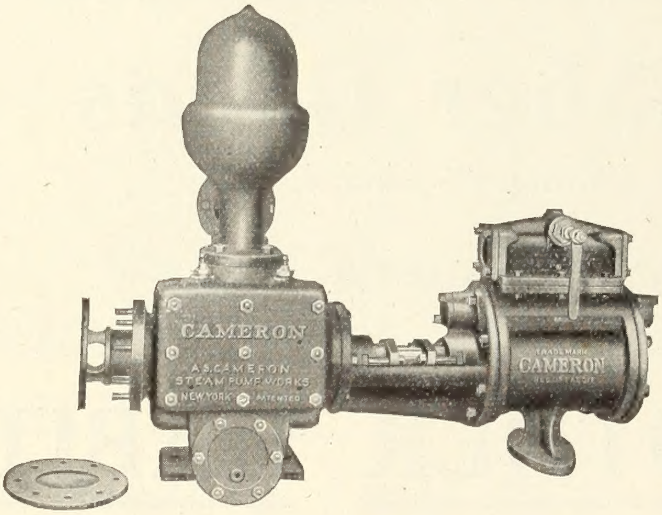
Our line-up is complete, our quality is unexcelled, and our prices are right. Let us show you what we can do.

It is our desire to serve you.

**Canadian Consolidated
Rubber Company, Limited**
Montreal, P. Q.

28 "Service" Branches
Throughout Canada

CAMERON
REMOVABLE BUSHING
PUMP



"Renew the Bushing Instead of Re-Boring the Cylinder."

A Saving of Time and Money

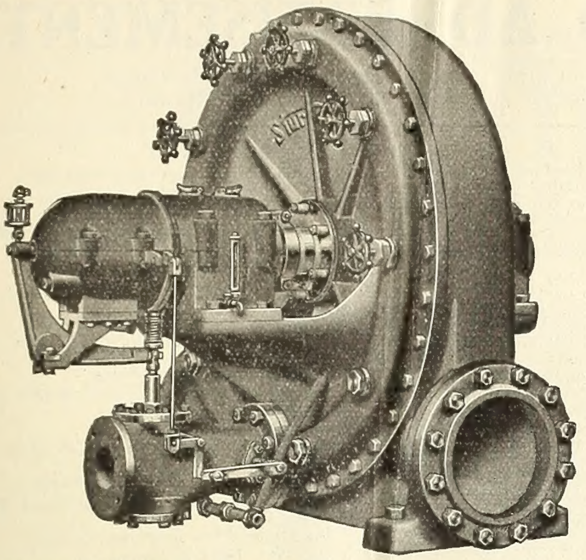
It takes a long time to wear out one of these bushings. The wear is usually greatest at the bottom of a cylinder and the bushing may be gradually turned to distribute the wear equally.

By putting in a smaller bushing the proportions of the pump may be changed, enabling it to pump against a greater head.

The Ideal Contractor's Pump

A full stock of Cameron Pumps and parts carried at our Sherbrooke works and branch warehouses.

CANADIAN INGERSOLL - RAND CO., LIMITED
COMMERCIAL UNION BUILDING, MONTREAL, CAN. - WORKS: SHERBROOKE, QUE.
Sydney, Montreal, Toronto, Cobalt, South Porcupine, Winnipeg, Nelson, Vancouver.



Sturtevant Turbine showing part of main governor mechanism. Note also emergency governor mechanism and the valve it operates. Valve is in supply pipe just outside Turbine casing.

Governing Mechanism of Sturtevant Turbines

(REG. CAN. PAT. OFF.)

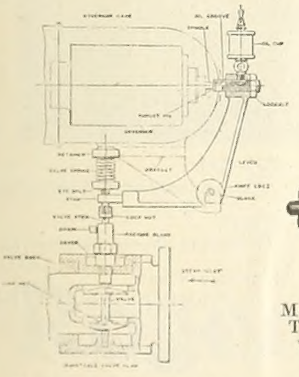
Excellent speed regulation is insured by a powerful direct-connected centrifugal governor. The two revolving weights illustrated directly actuate the balanced throttle valve which effectively controls the steam supply.

Besides the main governor there is an independent emergency governor set at a predetermined maxium speed. Both its mechanism and valve are entirely separate from the main governor. Should the predetermined maximum speed be reached the emergency governor instantly and automatically shuts off the steam.

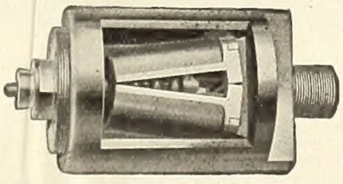
For other details of Sturtevant Turbines get catalog 210-Z.

B. F. Sturtevant Company
of Canada, Limited
Galt, Ontario, Canada

Selling Agents:
Sanford Riley Stoker Co., Limited
"THE RILEY STOKER"



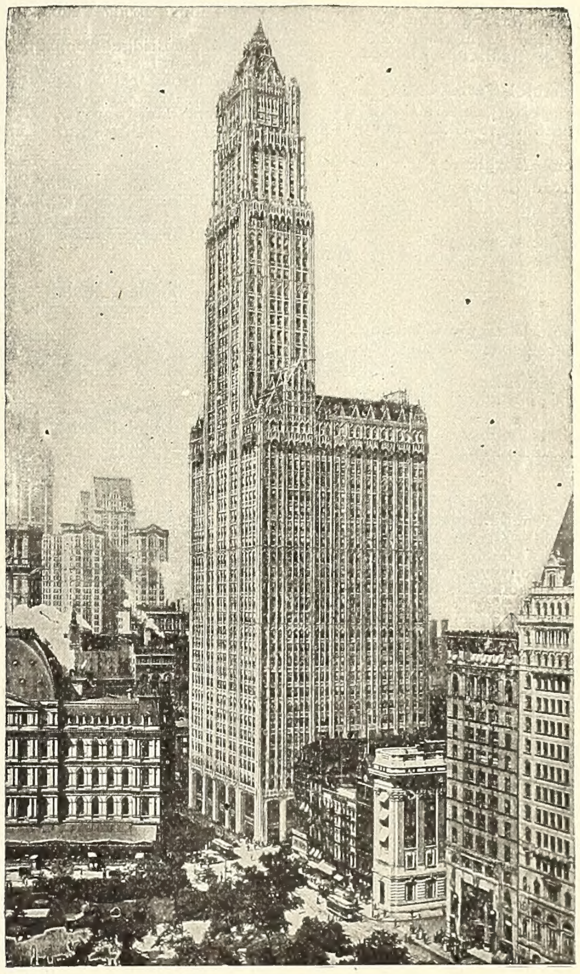
Section of Operating Mechanism of Main Governor.



Main governor with casing removed. Threaded end of governor barrel, which is screwed directly into the main shaft is seen at right. End of hardened steel spindle which is shown at right, acts against thrust pin shown in section drawing.

TOCKOLITH
AND
No. 49 R. I. W.

Were selected in preference to all other preparations for the protection of all structural steelwork in the "World's Highest Building."



Woolworth Building, New York City

BECAUSE no other materials on the market combine the same high resisting qualities, ease of application and permanency of protection as the "R. I. W." Products. **That's why** the Metropolitan Tower, Singer Bldg., Bankers' Trust Bldg., Pennsylvania Terminals and the majority of other world famous structures throughout America are permanently protected by **Toch Brothers' Materials.**

Copy of Red Book and Tockolith Booklet will be gladly furnished upon request to nearest distributor or

R.I.W. Damp Resisting Paint Co.
(Toch Bros., Est. 1848)
202 Mail Bldg., Toronto Factory: Oakville, Ont.

Distributors:
Black Building Supply Co., Limited, Toronto
Dartnell, Limited, Montreal
Western Paint Co., Winnipeg
Canadian Equipment & Supply Co., Limited, Calgary and Edmonton

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The following regulations apply to all advertisers:—Eighth page every issue, three headings; quarter page, six headings; half page, twelve headings; full page, twenty-four headings.

Adamantine Steel
Hull Iron & Steel Foundries

Air Compressors
Can. Ingersoll-Rand Co., Ltd.
Smart-Turner Machine Company.

Architects' Instruments
Stanley Company, W. F.

Architectural Iron Work
Aikenhead Architectural Iron Works
Canada Wire & Iron Goods Co.
McGregor & McIntyre
Steel & Radiation Limited

Architectural Terra Cotta
Northwestern Terra-Cotta Co.
Toronto Plate Glass Imp'tg Co.

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Asphalt & Supply Company
Barber Asphalt Paving Co.

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Can. Consolidated Rubber Co.

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Dominion Belting Company
Goodyear Tire & Rubber Co.

Belting (Conveyor, Thresher, etc.)
Can. Consolidated Rubber Co.

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Hopkins & Co., F. H.

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Canadian Blower and Forge Co.
Can. Ingersoll-Rand Co., Ltd.
De Laval Steam Turbine Co.
E. Laurie Company
Sheldons Limited
Sturtevant Co. of Can., Ltd., B. F.
Turbine Equipment Company

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Boving Company of Canada
Inglis Company, John
Marsh & Henthorn
McDougall Caledonian Iron Wks.

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Standard Underground Cable Co. of Canada Limited

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Bradford Pressed Brick Co.
Don Valley Brick Works
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Sudbury Construction & Machinery Company

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Crossley Machine Company
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Trussed Concrete Steel Co.

Cast Stone Blocks
Cast Stone Block & Machine Co.

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Morrison & Co., T. A.
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Hull Iron & Steel Foundries

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Cement Gun Company

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De Laval Steam Turbine Co.
E. Laurie Company.
Turbine Equipment Company

Ceresitol
Ceresit Waterproofing Co.

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Canadian Fairbanks-Morse Co.
Goold, Shapley & Muir Co.
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Lecky & Collis
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Watson Wagon Co.

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Electric Impulse Clocks
Gent & Company

Electric Steel Castings
Electric Steel & Metals Co.

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Roelofson Elevator Works
Turnbull Elevator Co.

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Pullar, H. B.
Tyrrell, H. G.

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Sheldons Limited
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American Water Softener Co.

Filtration Plants
verMehr Engineering Co., John

Fire Brick
Smyth & Ryan

Fire Escapes
Manitoba Bridge & Iron Works
McGregor & McIntyre

(Continued on page 12)

For **Permanent** Lines :

CAST IRON PIPE

for

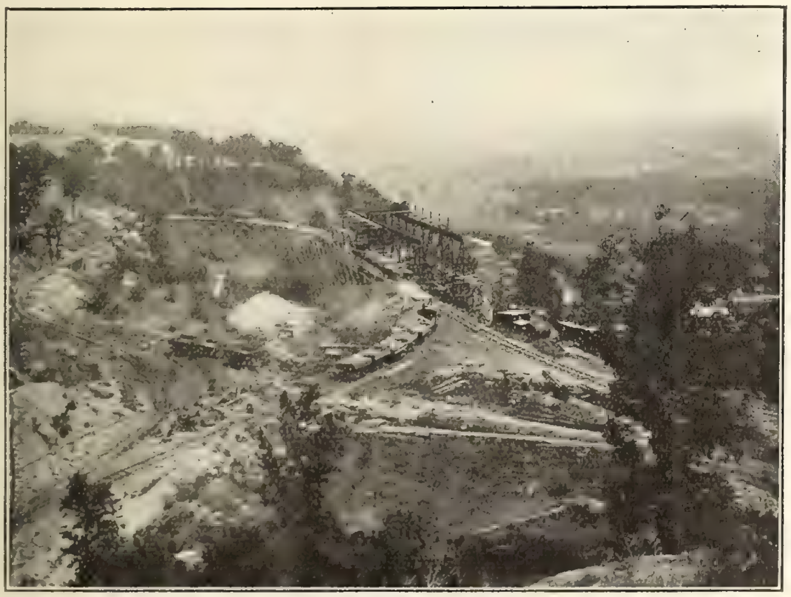
Water and Gas Supply, Fire Protection, Road Culverts, etc.

30″ Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

General Offices:—BURLINGTON, NEW JERSEY

Sales Offices —Philadelphia, Chicago, Buffalo, Portland, (Ore.,) New York, Chattanooga, Pittsburgh St. Louis, San Francisco



DUNDAS QUARRY

Capacity 4000 Tons Daily

OUR

Facilities for supplying any quantity of

CLEAN CRUSHED STONE

Are Unexcelled

SHIPMENTS — G. T. R. & C. P. R.

Team Delivery If Required

CEMENT

SAND

GRANOLITHIC

TRAP-ROCK

Rogers Supply Co., Limited

28 King St. W., Toronto

MAIN 4155

What's the Time?

There would be no argument on this subject if the "PULSYNETIC" Electric Clocks were installed.

They are invariably correct because they depend on the unvarying force of gravity.

Accurate and uniform time is shown throughout any building in which they are installed.

Easily fixed, no winding and no skilled attention is required.

Send for Book No. 5

which contains fullest information about all classes of Electric Clocks.

GENT & CO., LTD.

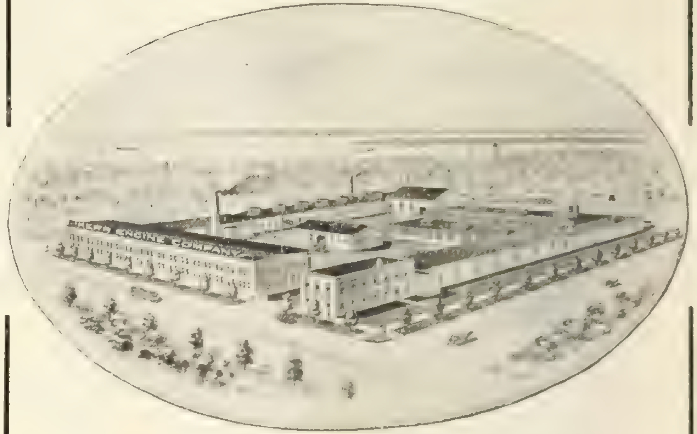
Leicester, England

Particulars and prices may be obtained from W. Ashall, 442 Sherbourne Street, Toronto.

KERR

Gate Valves and Fire Hydrants

"MADE IN CANADA"



This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

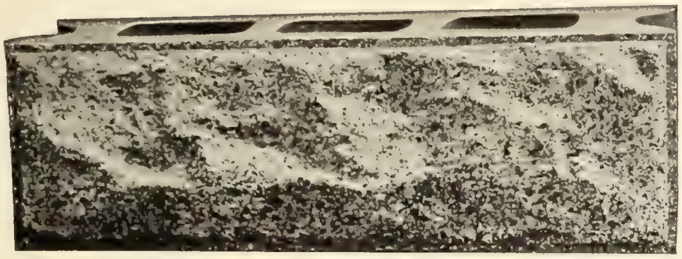
that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited

WALKERVILLE, ONTARIO



8 x 8 x 24 inch Granite Rock Face Block

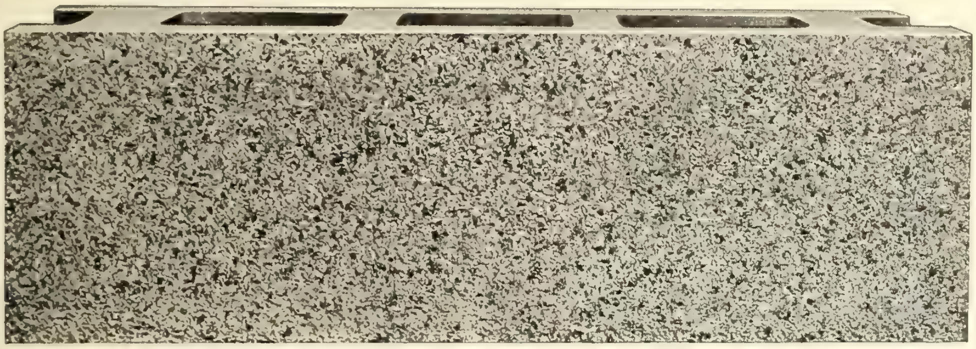
Molds for Casting

Waterproof Hollow Cement Building Blocks

With Granite Faces

THEY COST LESS — THEY SELL FOR MORE
YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited **(Zagelmeyer System)**
298 Howard Avenue, WINDSOR, ONTARIO

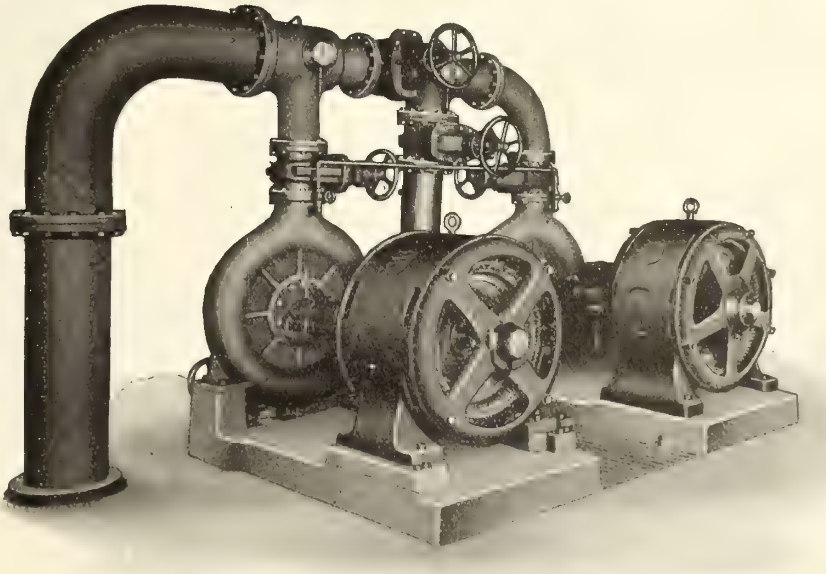
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



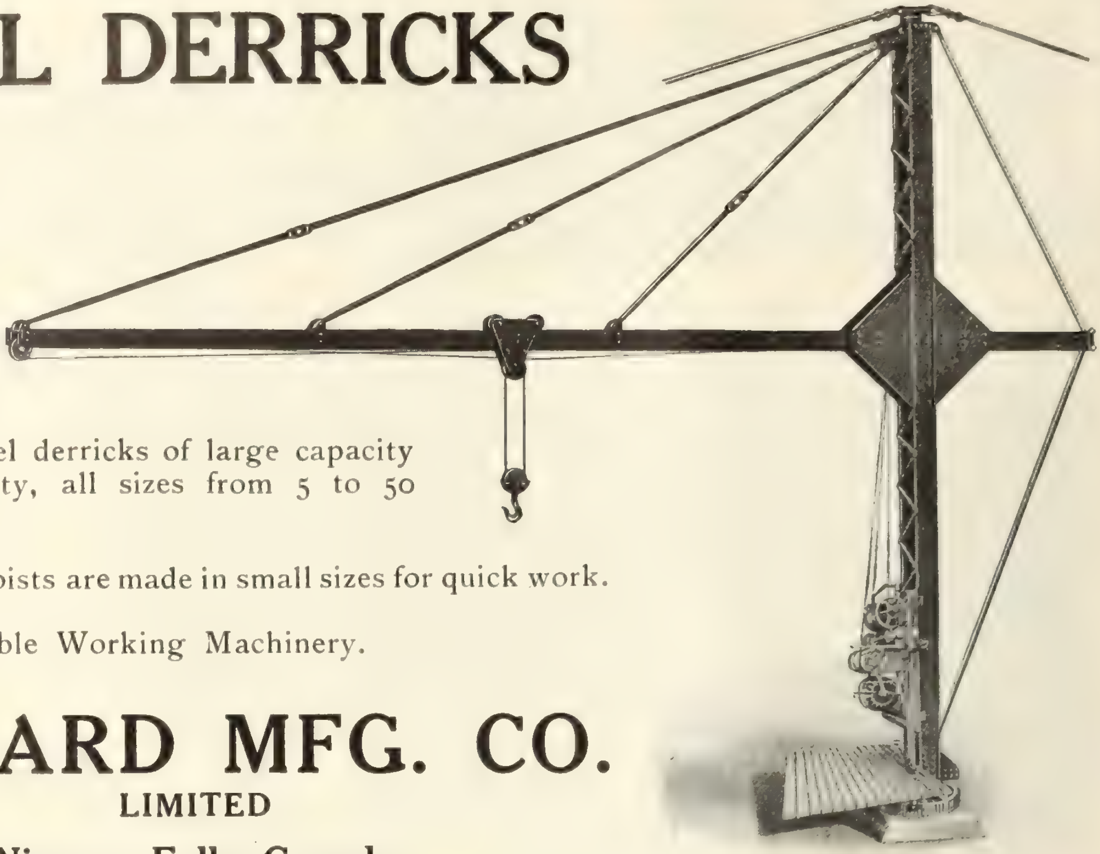
Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

STEEL DERRICKS

Cranes
Hoists
Derrick Irons



High class steel derricks of large capacity are our specialty, all sizes from 5 to 50 tons.

Our Electric Hoists are made in small sizes for quick work.

Stone and Marble Working Machinery.

POLLARD MFG. CO.
LIMITED
Niagara Falls, Canada

A TUEC CLEANED HOME

Residence of T. Fussell Esq., Oakmount Rd., Toronto

There is a Tuec Machine for the vacuum cleaning of every class of building.

TUEC
Stationary Air-Cleaning System

TUEC COMPANY OF VANCOUVER
601 Pender St. West, Vancouver

TUEC COMPANY OF WINNIPEG
505 Boyd Block, Winnipeg

TUEC COMPANY OF ALBERTA
105 Sixth Ave. West, Calgary

TUEC COMPANY OF MONTREAL
406 New Birks Bldg., Montreal

JAMES J. MARTINDALE
B. O. T. Building, 159-61 Richmond St. W., Toronto

TRADE MARK

Hull Iron & Steel Foundries, Limited

Head Office and Works - HULL, QUEBEC

Manufacturers of Steel Castings

Chrome, Manganese and Nickel Steel Castings

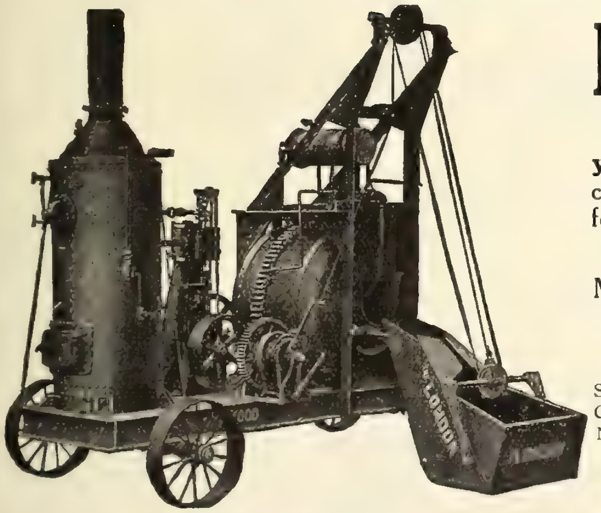
Annealed and Unannealed

Repair parts for Stone Crushing Plants, Mining Machinery and Cement Mills our specialty.

Machine Moulded Gears

any size up to 18 feet in diameter made without patterns.

We solicit your patronage and prompt attention will be given to any orders.



London Batch Mixer

LONDON Batch Mixers

London Batch Mixers cost less because they will **run for years without repairs,** or break-downs. They produce more Concrete, they **make better concrete** and **do it in less time.** These features mean **clear profits** to the Contractor instead of loss.

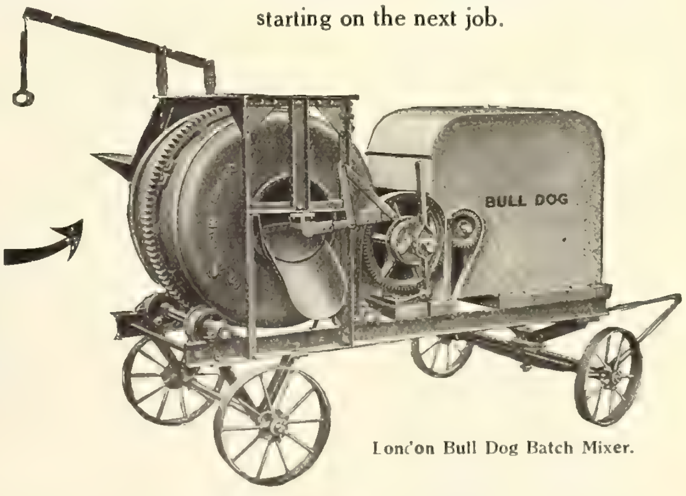
Every Mixer Sold Sells Ten More. 2000 Now in Use.

Made in all sizes from ¼ yd. to 2½ yd. Batch. Get prices now before starting on the next job.

Send for Catalogue No. 1.

LONDON BULL DOG BATCH MIXER

A Small Batch Mixer for Small Contract Work. 6 cu. ft. Batch, 50 cu. yds. per day. Can be operated with less men than any other Mixer. **Pays for itself in 15 days' use. Every contractor with small jobs should own a Bull Dog Batch Mixer.** Send for Catalogue No. 1B.



London Bull Dog Batch Mixer.

We make 23 different sizes and styles of Concrete Mixers also a full line of Concrete Machinery and Cement Working Tools.

London Concrete Machinery Co., Limited, London, Ont.

Branches and Agencies in every large city in Canada.

WORLD'S LARGEST MANUFACTURERS OF CONCRETE MACHINERY AND CEMENT WORKING TOOLS.

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

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  Hope & Sons, Henry
  Ormsby Company, A. B.
  Pedlar People Limited
  Steel & Radiation Limited
  Trussed Concrete Steel Co.

Floor Hardener
  Ceresit Waterproofing Co.

Force Cups
  Can. Consolidated Rubber Co.

Fuel Economizers
  Sturtevant Co. of Can., Ltd., B. F.

Furnaces,
  Toronto Furnace & Crematory Company

Fuse (Safety Blasting)
  Lecky & Collis

Forges
  Canadian Blower and Forge Co.
  Sheldons Limited

Form Clamps
  Peerless Form Clamp Co.

Gaskets
  Can. Consolidated Rubber Co.

Gas Engines
  Armstrong Mfg. Co.
  Goold, Shapley & Muir Co.

Gasoline Engines
  Armstrong Mfg. Company
  Canadian Fairbanks-Morse Co.
  Goold, Shapley & Muir Co.
  London Concrete Machinery Co.

Generators, Turbine Driven
  De Laval Steam Turbine Co.

Glass
  Consolidated Glass Company
  Excelsior Plate Glass Co.
  Luxfer Prism Company
  Pilkington Bros.
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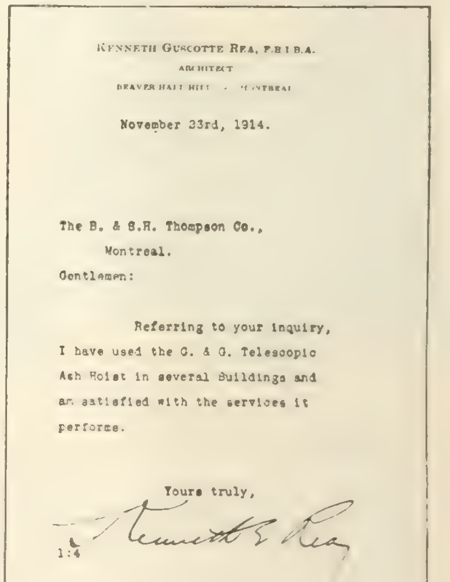
(Continued on Page 14)

A Typical Installation in Montreal—

The Guarantee Building, Montreal, (Architect, Kenneth G. Rea), is another of the numerous buildings in Canada in which is installed a G & G Telescopic Hoist for the removal of ashes.

Made in Canada

The G&G Telescopic Hoist PATENTED
with compound gear and brake attachment



KENNETH GUSCOTTE REA, F.R.I.B.A.
ARCHITECT
BEAVER HALL HILL - MONTREAL

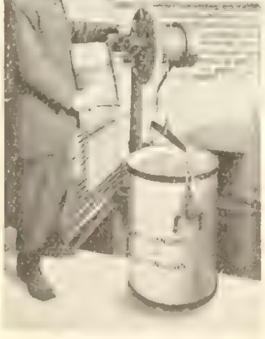
November 23rd, 1914.

The B. & S.H. Thompson Co.,
Montreal.

Gentlemen:

Referring to your inquiry, I have used the G. & G. Telescopic Ash Hoist in several Buildings and am satisfied with the services it performs.

Yours truly,
Kenneth G Rea
1:4



Raises a maximum load of 500 lbs. at an actual speed of 30 feet per minute. It is not only speedy, but also clean, convenient and noiseless in operation.

The G & G Telescopic Hoist is operated from the sidewalk. This form of construction safeguards the public against falling into hatch and protects operator from injury should anything drop through the hatch. When not in use the hoist telescopes and no part shows above street level. Every hoist subjected to thorough working test before shipment.

Write to nearest agent for Booklet and Prices.

GILLIS, & GEOGHEGAN, Sherbrooke, Que.

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"Made in Canada"

TRADE **CHAMPION** MARK
STREET SPRINKLERS

All steel tanks, mounted upon steel underframing, platform, spring gears. Springs tested for the different capacity tanks under which they are placed. Choice of valves. Wheels made of the best XXX oak rims, spokes of split oak billets, and hubs of selected elm, with 5/8 in. thick tires. Three and four inch wide tires as desired.

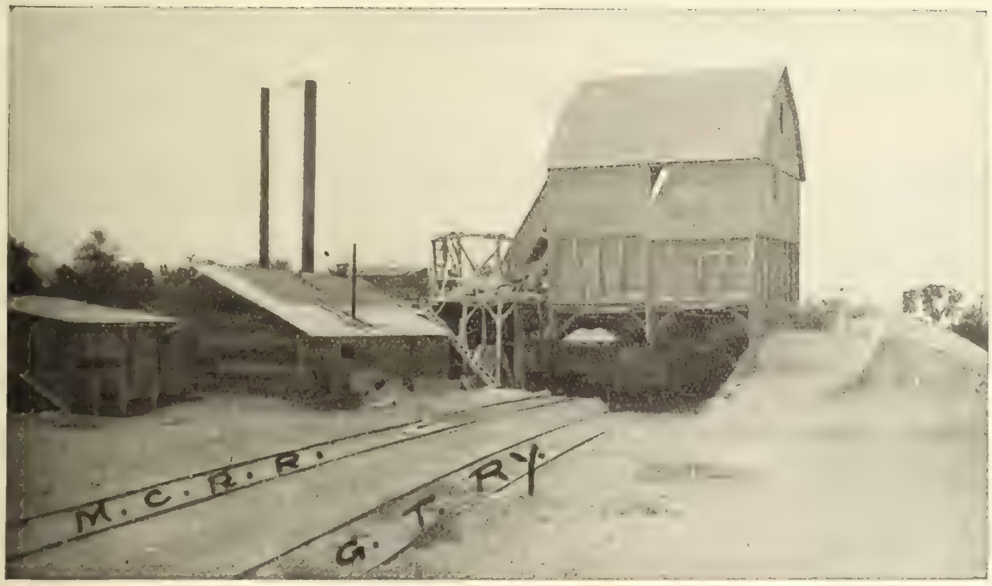
SEND FOR BULLETIN.

Capacity
350 Imperial Gallons.
500 Imperial Gallons.
600 Imperial Gallons.
750 Imperial Gallons.

A Full and Complete Line of Road, Street and Contractors' Machinery.
Write for Catalog.
Manufactured by

American Road Machine Company of Canada
Limited
GODERICH, ONTARIO

Macadam Roads



must be built of a
Tough Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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The Premier Road Dressing and Binder

"FLUXPHALTE" is a heavy road oil containing 80% of solid pure bitumen combined with sufficient liquid bitumen to bring it to a proper consistency for road dressing. It is absolutely free from greasy oils.

This asphalt macadam binder which we are introducing into Canada has stood the test of time and is offered to the municipalities of the Dominion with the highest recommendations of critical road engineers in Great Britain.

Today the heavy traffic on roads has found the old water-bound macadam unsuitable, and in order to provide a binder and dust-layer which will stand up under these new conditions, "FLUXPHALTE" has been placed on the Canadian market

"FLUXPHALTE" is as easily applied as any binder and gives far better results

Write for copy of our New Booklet.

The Asphalt and Supply Company, Limited
103-107 Board of Trade Bldg. - - MONTREAL

TRINIDAD LAKE ASPHALT

"A Lower Bid from the Undertaker"

"Yes," said the specialist, as he stood at the bedside of the sick purchasing agent, "I can cure you."

"What will it cost?" asked the sick man, faintly.

"Ninety-five dollars."

"You'll have to shade your price a little," replied the purchasing agent, "I have a lower bid than that from the undertaker."

The Purchasing Agent's line of reasoning in this story is responsible for a lot of poor asphalt pavements. You can always get a ***low*** bid from the undertaker, but is it the ***best*** bid?

In the first instance you can't get the best pavement for the least money.

But in the long run a Trinidad Lake asphalt pavement gives ***more service*** for the money expended than any other pavement gives.

Ask for "Evidence," a record of 20-to-30-year-old Trinidad pavements.

The Barber Asphalt Paving Co.
PHILADELPHIA, PA.

A Vital Message to Architects and Builders

Heed This Testimony

How to Increase the Capacity of Buildings

Duluth, Minn., Feb. 20, 1915.
Ceresit Waterproofing Co., Chicago

"Satisfaction once generally brings repeat orders, and here is one:

> "We wish you would ship us immediately, 3,700 lbs. of CERESIT Waterproofing Compound for 10,300 sq. ft. of 3-in. concrete floor finish, the waterproofing of which will be mixed in a concrete mass, which we intend to lay in our other buildings.

"It, no doubt, would be interesting to you to know that on the basement waterproofed last fall which we moved into the first of November, we have not had a sign of leakage of any kind, and your engineers, no doubt, have informed you of the extraordinary difficulties we had to encounter in waterproofing the basement in question.

"From the experience we have had up to date in the use of your material, we certainly cannot speak any too highly of it."

NORTHERN COLD STORAGE
& WAREHOUSE CO.
A. M. McDougall, Mgr.

The Everlasting Waterproofing

For basements, underground passages, coal pits, boiler pits, elevator pits, conduits, water towers, swimming pools, aqueducts, dams, etc.

CERESIT is a plastic paste which readily dissolves in the water used to temper the concrete or cement plaster, rendering it as impervious to water as welded steel.

Our engineers co-operate with architects and engineers in solving their waterproofing problems. Let us assist you. Ask for valuable data.

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Ceresit Waterproofing Company

983 Westminster Building
Chicago Ill.

CERESIT
TRADE MARK REGISTERED

Added One More Usable Floor
To This Building

Warehouse built on filled ground, mostly sand and gravel, with a boat slip on both sides. Basement is about three feet below water level and subject to heavy hydrostatic pressure and was effectively waterproofed by using CERESIT in top finish of floor and in a cement mortar coating applied to the inside of the walls.

RESULT: A permanently DUST DRY basement affording valuable space at a small additional expenditure.

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Passenger
Freight
Hand Power
Dumb Waiters

The Turnbull Elevator
Mfg. Company
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Tarvia

Preserves Roads
Prevents Dust~

Made in Canada

Outremont—a Tarvia Town

OUTREMONT, a handsome and exclusive residential section of Montreal, built two of its principal avenues with Tarvia as a binder in 1912.

Tarvia is a dense and tough coal tar product. "Tarvia X", the densest and heaviest of the three grades of Tarvia, was used in Outremont.

In hot fluid form it was poured upon the stone when the road was built and hardened upon cooling, thereby enclosing the stone in a tough, plastic matrix.

Being a coal tar product, Tarvia is naturally waterproof and frost-proof, and accordingly these tarviated surfaces shed water instantly and never form mud.

This Tarvia-concrete withstands automobile traffic perfectly. The grinding of the wheels cannot loosen the stone or create dust. The surface is always clean and firm and is, of course, vastly more durable than plain macadam.

The results of Outremont's experience with tarviated macadam are amply stated in the simple fact that after two years' experience Outremont now uses Tarvia almost exclusively in pavement work throughout the town.

There are many other such "Tarvia towns" all over the Dominion.

Stuart Avenue, Outremont, Quebec, built with "Tarvia X" in 1912.

Special Service Department.

This Company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by anyone interested.

If you will write to the nearest office regarding road problems and conditions in your vicinity the matter will have prompt attention.

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MONTREAL TORONTO WINNIPEG VANCOUVER
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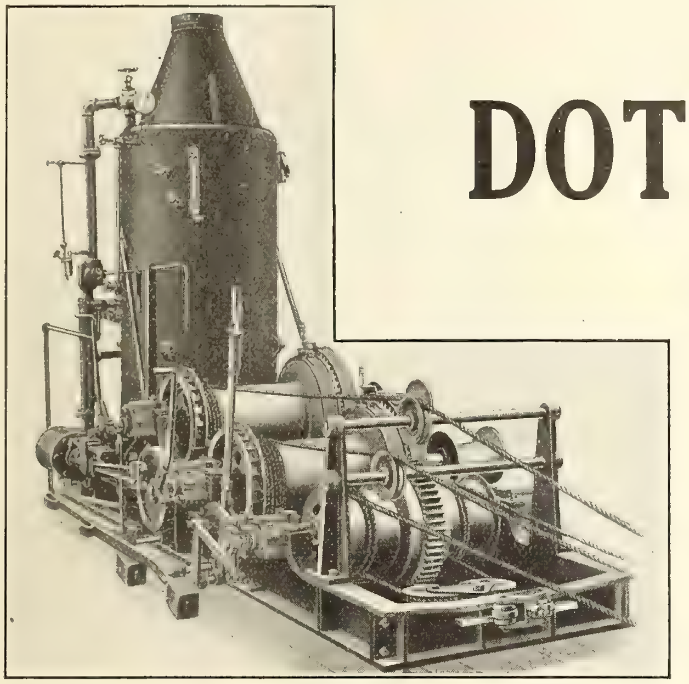

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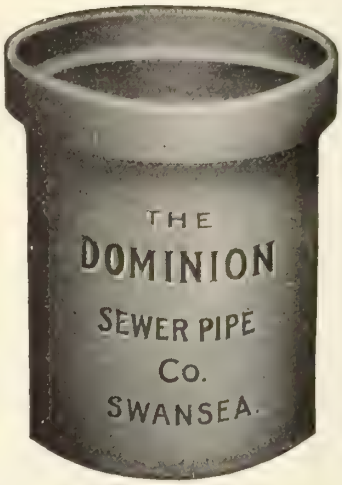

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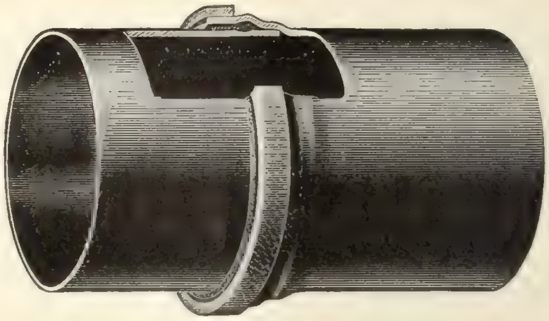

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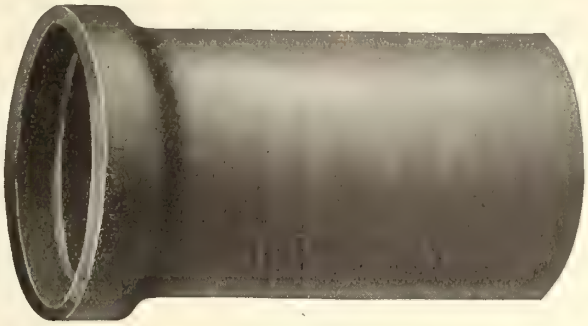

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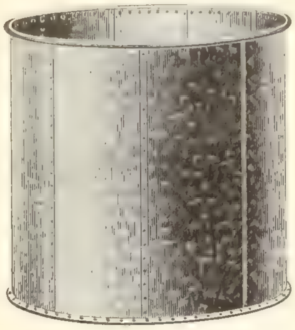

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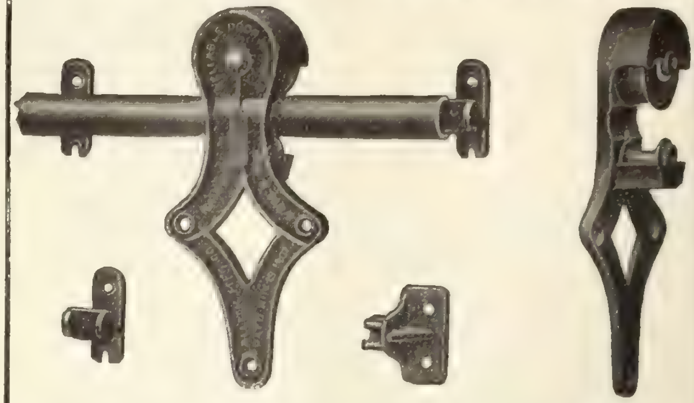

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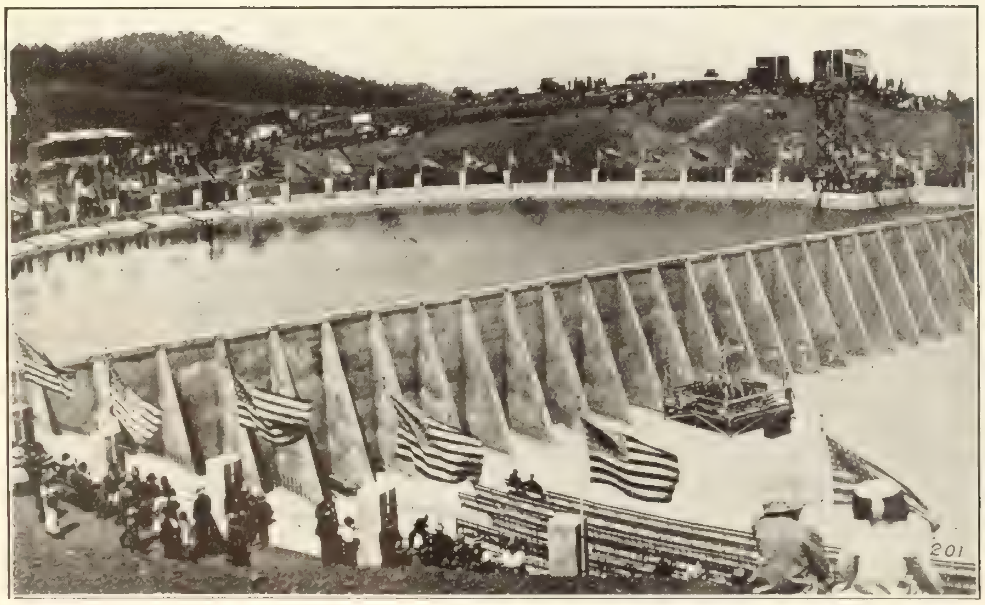

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ESTABLISHED 1886

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The Cost-plus-a-Fixed Sum Method as a Substitute for Contract Work

THE award of contracts on the "cost-plus-a-fixed sum" basis, which is the subject of a recent communication, has certain phases which are worthy of comment. The advocates of this method contend that the "lowest price" is not often the best price, and that it does not represent the value that it has on paper. There may be an element of truth in this argument, but the contentions adduced further savour of the utopian: it is urged, with some reason, that the present system of competition among contractors is not wholly advantageous to the owner, while it is often ruinous to the contractor; but there are defects in every human system, and it is difficult to see how the main end—that of competition—is to be served by the "cost-plus-a-fixed-sum" method.

The communication to which we have referred comes from Mr. H. Sayward, Secretary of the Master Builders' Association, of Boston, who tells us that "competition under 'cost-plus-a-fixed-sum' is competition 'before the fact'—that is, before the owner comes forward with his proposition to build." This is a peculiar statement, and it is none the more lucid by virtue of its association with a legal quibble. Can any one imagine competition after the fact? In explanation, Mr. Sayward proposes that builders should "demonstrate" to the prospective owner what they have accomplished in the past in the way of economical, speedy and effective work. "In this way," he says, "there will be a very real competition, in which builders will vie with one another for the favour of owners who are to build in the future. Likewise there will be a notable cutting of costs to the owner—and it will be a cost that will stay cut, because there will be no temptation to 'skin the job' in order to avoid loss on the contract."

To our mind this argument is absolutely unsound, and it is astonishing to find it advanced by those who lay claim to speak with authority on contracting matters. What Mr. Sayward advocates is a sort of competition of reputations, without the consideration of dollars and cents—a hopeless proposition. Reputation is a common factor in both cases, so that under the "cost-plus-a-fixed-sum" system building contracts are removed from the active area of competition, and the field is thrown open to untold malpractice on the part of the architect—and it is quite as necessary to keep a close eye upon the architect as upon the contractor. Collusion between architects and contractors

An Appreciation from Holland

Rotterdam, April 19, 1915.

Editor Contract Record:

The Empire Number of The Contract Record and Engineering Review is a most valuable publication, and will be very useful as a book of reference. I have read many of the contributions with great interest—notably those by the Honourable the Minister of Trade and Commerce and by the Commissioner of Commerce.

Yours faithfully,
J. T. Lithgow,
Canadian Trade Commissioner.

has been an endless source of trouble in the building business.

We are told of a contractor who effected a saving of seven cents in cost per cubic foot of brick laid by improved methods of transporting the material to the stagings. This may have been done—we should like to know how—but it is hard to accept the statement that such a reduction of cost "would seem to be particularly a development of the 'cost-plus-a-fixed-sum' method." Surely there is far greater incentive to such economies in ordinary competitive work, where the contract price is a fixed quantity.

Whenever anybody comes forward with a departure from established rule he makes a mistake in trying to build up the new system by pulling down the old. It is no special recommendation for the "cost-plus-a-fixed-sum" method that under the contract system "a careless, indolent or unscrupulous contractor is open to the temptation to save himself or add to his profits by skimping work and materials, by 'skinning' sub-contracts, or by other such practices, rather than by cutting the cost through improved methods." Such statements build up a wall of prejudice which makes it impossible to discern virtue in the alternative proposition—though it may have some.

The very foundation of contract work is reputation. In these days of keen competition, especially, one might paraphrase the old saying into "Give a contractor a bad name, and hang him." A man with a building proposition to put through would be addlepated indeed were he not to give the greatest consideration to the reputation of the men he employed—first and foremost the architect, and then the contractors,—the select few upon whom one can always rely for an honest job, put through on a scientific basis of economy and efficiency.

Rogues, like the poor, we shall always have with us; but we can see their number multiplied by the substitution of the "cost-plus-a-fixed-sum" method for the contract system.

Concerning Annual and Other Reports

It is common knowledge that in an architectural competition to be judged by laymen an attractive, easily understood picture usually wins over a plain, uninteresting drawing, despite the fact that the latter may present much the better design, comments The Engineering Record. Engineering works frequently do not lend themselves to pictures made by either pencil or camera. Consequently, word pictures become the more important. Whether describing work done or to be done, whether annual or special, that report will be most successful in winning approval which first arrests attention, then holds interest by a sequential, live and logical development of the subject, and finally leaves in the reader's mind a clean-cut, comprehensive idea of the project, with the most important elements standing out in relief, in proper relationship.

Successful report writing demands an imagination which can work from the viewpoints of the probable readers, and which, therefore, can perceive the features which will interest them, and conceive ways for putting life into the "deadly uninteresting." To this end a rich vocabulary, precise diction, intelligent discrimination in the use of words, and skill in arrangement of chapters, paragraphs and sentences, all contribute. Native deficiencies in these directions can largely be made up by painstaking work. Too frequently unimportant ideas or words are carelessly allowed to fall into prominent positions. Involved and incoherent sentences and tedious sameness of expression destroy interest. Poor English is an unfit vehicle for presenting good engineering.

Illustrations have much to do with the success of some reports. If photographs, they should be good pictures as well as making plain the subject to be brought to the readers' attention. Titles, while concise, should be sufficiently complete to bring out the full value of the picture. In some cases explanatory matter beneath the title is desirable. These suggestions will apply also to maps and other drawings. In drawings common faults are overcrowding—seeking to show so much detail that after reduction clearness is lost—lack of relief by failure to use lines of different weights to give prominence to the main features and subordinate the minor, and lettering so small that after reduction it is illegible, or, at best, discouraging to most eyes. Each illustration, if practicable, should be placed near the text to which it is related.

Typography, also, is important. A clean, easily read text often may be displayed to advantage by suitably balanced chapter, page and paragraph headings. Such headings, if skilfully used, are valuable aids in catching attention and in finding information sought. Titles of tables should be complete and accurate, and column headings, while brief and even abbreviated, should not leave the reader in doubt.

But annual reports are not written and printed solely for the outsider. Not infrequently they are the most surely permanent record and the most convenient reference book for use in the further conduct of the work. These uses should be kept in mind in their preparation, but the annual report should not be burdened with matter which rightfully belongs in a manual of instructions for employees. Details, too, belong in appendices, not in the main report, while tabular matter relating to routine matters should remain in the record books of the department.

Primary facts are all too commonly left unstated. A report writer having progressed far into the details of the work sometimes loses his perspective and forgets that information which long ago became part of the subconscious groundwork of all his thinking has not yet been imparted to his reader, yet is fundamental to a correct understanding of the more detailed statements.

Once in a while a report has to be searched for its date, which ought to be in a conspicuous place, and occasionally the outside of the bound book does not display conveniently the name of the community or department. A serial number placed on the back is often useful for reference. A distinctive, pleasing color for the cover is worthy of consideration. More frequent use of good colors would break the monotony of dull, funereal black which dominates some libraries of engineering books. Enough has been written in the past about standard size to warrant silence here on that detail of the subject.

Some of the suggestions which are pertinent for a large city or department do not, of course, fit a small town ,but in any case a report should be suitable for its purpose and its readers, and should do justice to the work to which it relates. If the purpose be clearly borne in mind and precedent disregarded the improvement would be immediate. Such improvement is earnestly to be desired to the end that the public at large may be more interested than in the past in the works for which it is called upon to pay.

War Contracts Increasing

MANY of the smaller industrial plants are profiting by the War. For example, we hear that the Fisher Motor Company, of Orillia, have a contract which means turning out six hundred 3-inch shells a day for several months. Their factory is now running twenty-four hours a day. Then from Seaforth, Ont., we hear that the Bell Engine Works are running night and day on orders for shells, and that they are making enterprising arrangements in regard to staff and equipment so as to be able to execute additional contracts which they have received.

Ontario has had a generous share of war orders, but, as a matter of fact, the contracts are distributed pretty evenly. From a New Glasgow, N.S., communication we learn that the Nova Scotia Steel and Coal Company, the Eastern Car Company, the Canada Tool and Specialty Company, the Eastern Steel Company, and the Maritime Bridge Company all have large contracts.

The Ross Rifle Company are said to be making five hundred rifles a day, and paying a wage bill of $25,000 a week.

The war has its compensating features.

Sam Hughes Speaks

LAST week, in the House of Commons, the Minister of Militia for once made a statement worthy of note. This was that arrangements were now being made whereby Canada would refine her own copper, purify her own zinc, and manufacture her own brass for war munitions. In this connection it is of interest to report that an investigation which has an important bearing on the manufacture of shells has just been concluded by Dr. Alfred Stansfield, Professor of Metallurgy at McGill University, Hon. Col. David Carnegie, of the Shell Committee in Canada, and Dr. A. W. G. Wilson, of the Mines Branch, Ottawa. These gentlemen have just returned from a three weeks' tour of Western Canada, where an investigation was conducted with a view to establishing a copper refinery and zinc reduction works. At present all the copper mined in Canada has to be sent to the United States to be refined, and the same thing applies to the zinc ores. If the refining and smelting can be done within the Dominion it will be a great achievement for Canada, not only from the military standpoint, but commercially.

A good report is to hand from Mr. M. H. MacLeod, General Manager of the Canadian Northern Railway, who has just returned from a trip through western Canada. Mr. MacLeod is particularly impressed with the favourable outlook. He tells us that the crop prospects are excellent, and that there is a much larger acreage under seed. His own company has made plans for carrying out extensive construction this season. All the details have not yet been completed, and a definite announcement will be made shortly. A large number of men are to be put at work on the main line in the West.

Berlin's Offence

MUNICIPAL councils throughout Ontario should take an awful warning from the experience of the city of Berlin, whose City Council have received an ultimatum from Dr. McCullough, Chief Inspector of the Provincial Board of Health, giving them until November 10 to install an efficient sewage disposal system. Some years ago the civic authorities there put in a sewage disposal plant, but they neglected to provide for the increasing amount of sewage created by numerous large industries and the growth of the city—with the result that the filtration beds have been overworked, and raw sewage has been entering the creeks and streams. The plant was designed for a capacity of 650,000 gallons, and the present flow is estimated at 2,000,000 gallons. Since 1906 the only additions to the plant have been three acres of sewage beds, increasing the previous capacity by about 125,000 gallons.

Such a state of affairs reflects little short of criminal negligence, and it is to be hoped that the provincial authorities will make an example of the town with the German name, and see that the law is not being transgressed similarly by other municipalities.

* * *

By the way, one would hardly expect a town with such a name as Berlin to have an efficient sewage disposal system. It is a matter for astonishment that the authorities do not change the name of the place. "What's in a name?" the Immortal Bard says; and at a time when every English-speaking community is giving its best blood for the preservation of British ideals we reply, "A great deal, when it reminds us of anything German." We have the example of Russia: there is no longer a St. Petersburg; it is now Petrograd. Why should Canada tolerate a Berlin and a Prussia, a Dresden and a Breslau, a Bismark and a Holbein, a Holstein, a Heidelburg, and a dozen others of the same ilk? We are quite ready to absorb good German citizens, but it is infamous for Canadian towns to bear German names. This is a matter more for the daily press than for the technical press, but just the same it is a matter for every right-minded citizen with a British backbone in him.

Wanted—Reliable Cost Data

NOTHING is sought more keenly by technical papers than costs first, costs second and costs last. But few engineers are willing to make public this information in detail, and still fewer executives will sanction such a course by a broad-minded subordinate.

A stock objection raised by the operator, when costs are requested, is that such figures would be of no use as a guide to others. And then our old bugaboo, "local conditions," is trotted forth with all impressiveness of the stuffed lion in a Christmas pantomime. Of course, it is not pretended that figures are everything. In fact, figures offer only a starting point; but a starting point we must have.

The objection to giving out costs has lost much of its force in view of the detailed accounting data that must now be filed with public utility commissions.

Many of these data are available to anyone who cares to copy them; but unless the corporation is willing to aid in their interpretation, the most misleading conclusions may be drawn, for in the broadest sense the word "costs" must be understood to include an explanation of accounting practices and engineering standards.

Apropos of misinterpreted figures, a certain engineer protested quite vehemently at a published comparison with his costs as taken from a Government publication. Yet a few months before the same engineer refused to permit the publication of a descriptive article, with costs, that would have placed the practices of his company in a more desirable light.

In short, engineers and executives should give up the idea that they lay themselves open to attach when they permit costs to be published. The unmistakable trend of the times is toward publicity; and as with liberty, the evils of publicity are curable by still more publicity.

It is pleasing to learn that an early start is to be made on the summer's work of road building in New Ontario, for which the Provincial Government has provided $615,000. Of this sum, $90,000 will be spent on the highway along the T. & N. O., $75,000 on a road along the Transcontinental, and $50,000 on a trunk road from Sturgeon Falls to Sudbury. The rest of the grant will be apportioned among the other districts of New Ontario.

The Construction of the Mount Royal Tunnel for the Canadian Northern Railway

Specially contributed by J. L. Busfield, B.Sc.[*]

CONSIDERABLE progress has been made in the various stages of the construction of the Mount Royal Tunnel for the Canadian Northern Railway, and some portions of the work have been practically completed. The undercrossing of the Canadian Pacific Railway at the west portal is complete with the exception of certain final touches, part of the tunnel lining has been built in open cut, and only a small percentage of rock remains to be excavated.

C. P. R. Undercrossing

At the west portal of the tunnel the Canadian Northern tracks pass under the Canadian Pacific Railway with a difference in elevation of twenty-five feet, and immediately east of this crossing the Canadian Northern Railway "Portal" station has been built. The platforms of this station extend below the Canadian Pacific Railway, so that in designing the undercrossing provision had to be made for two tracks and two platforms. The traffic on the Canadian Pacific tracks being comparatively heavy, special attention was paid to making the design of such a nature that an absolute minimum of interference would be made with the Canadian Pacific Railway trains during the various stages of construction, and this was obtained by adopting the section shown in Fig. 1, which consists of four spans covered with flat reinforced concrete slabs.

Design

Between the two tracks (15 ft. 6 ins. c. to c.) is a centre wall, acting as a support for the main roof slabs. This wall is 18 inches thick, and is reinforced in each face with vertical bars ¾ in. square and 12 ins. c. to c., and with horizontal bars ¾ in. square and 2 ft. c. to c. The base of the wall spreads out into the footing, which is founded on rock, and contains the electric ducts and conduits. (See Fig. 1).

The space on either side of the centre wall is divided into two spans, respectively 6 ft. 9 ins. and 13 ft. 6 ins. clear, by a longitudinal reinforced concrete girder supported on columns situated on the platforms, spaced 10 ft. 4¼ ins. c. to c. The girders spanning the columns are 4 ft. deep and 2 ft. wide, and are heavily reinforced. The roof slabs spanning from the centre wall to the girder are 15 ft. 7 ins. long, 2 ft. 3 ins.

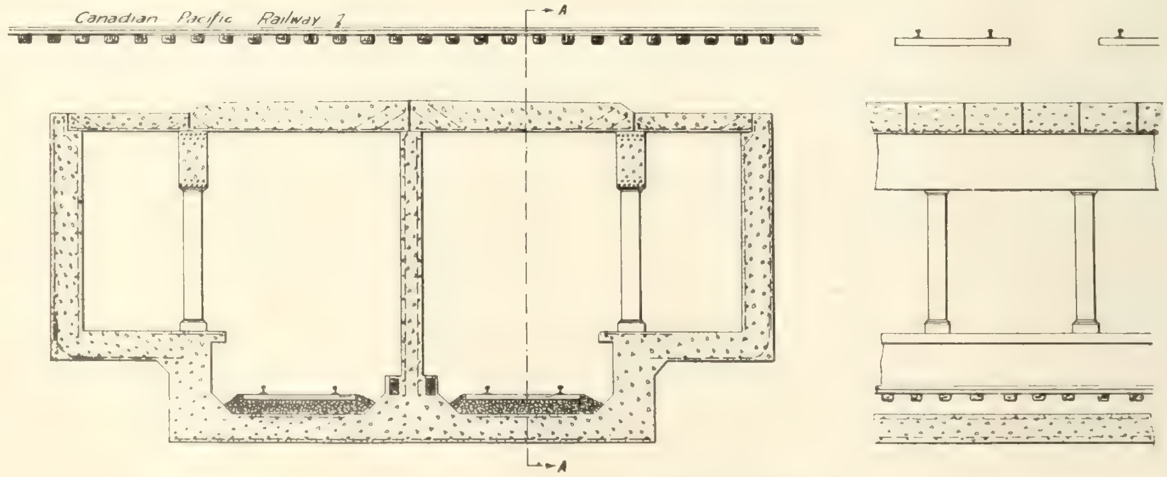

Fig. 1—Section at C. P. R. crossing, with reinforced roof slabs.

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[*] Assistant Engineer Montreal Tunnel and Terminal Construction.

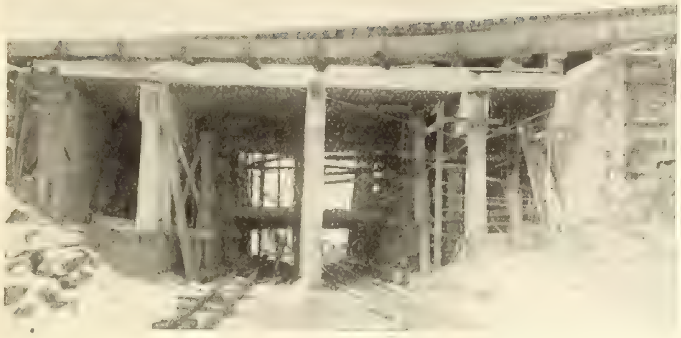

Fig. 2—View of C. P. R. crossing, with roof slabs in place.

deep, and 4 ft. wide, and are heavily reinforced. These slabs weigh about ten tons each, and are provided with stirrups of 1-in. square bars set in slots for handling purposes. A slab 15 ins. thick is used to span from the girders to the side walls, and is 10 ft. 4¼ ins. long and 8 ft. 2 ins. wide, and weighs approximately eight tons.

The side walls, platforms and foundations are all adequately reinforced with ¾-in. square bars. Joints are provided in the footing course so that the centre walls and columns are brought to their foundation independently of the tracks.

It will be noticed that a departure has been made from the standard Canadian practice in providing high platforms, level with the car floors. As the traffic at this point will be almost entirely local, and will be handled largely by the multiple unit cars, the time taken in loading and unloading the trains will be reduced to a minimum, and the inconvenience caused passengers by their having to climb down car steps will be eliminated.

Construction

As the excavation for the undercrossing proceeded piles were driven, and the Canadian Pacific Railway tracks were supported on falsework consisting of timbers and steel girders. When the necessary foundation had been prepared the concrete footings were poured, and the work carried on in stages until the centre wall, girders, and side walls had reached the level of the under side of the slabs. The tops were all levelled off preparatory to receiving the roof slabs, which were being made in the yard and allowed to set and season. The side walls were provided with expansion joints consisting of three-ply waterproofing fabric about 18 ins. wide. This was made up of two-ply roofing felt, with one-ply burlap on top, all plies saturated and mopped down with coal tar pitch. The rear surfaces of the side walls were mopped over with two coats of coal tar pitch. In Fig. 2 is shown a view of the crossing with the roof slabs in place. The flume in the top foreground carries the Canadian Pacific Railway water across the excavation.

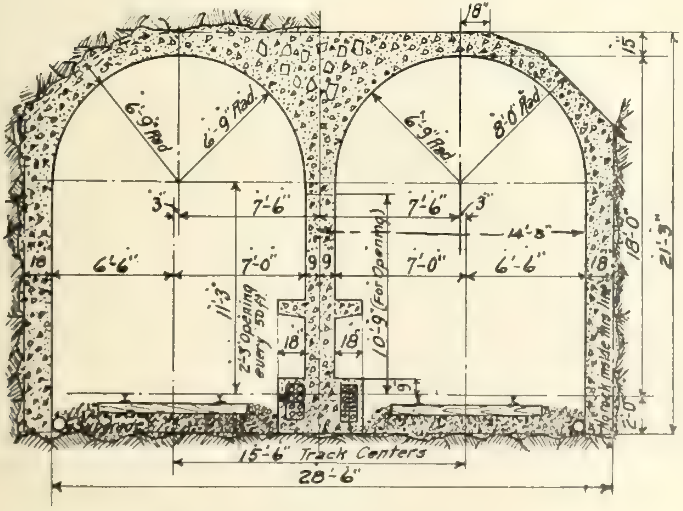

Fig. 3—Tunnel section as built in open cut.

Although there are only three tracks on the Canadian Pacific Railway at this point, the undercrossing has been built to accommodate the ultimate capacity of the right-of-way, so that the walls and girders projected to a considerable extent outside the limits of the existing tracks. This enabled the roof slabs to be set in place with very little disturbance to the trains on the main line tracks, as the slabs were all handled by means of a derrick car on the siding which placed them on to the bridge seats between the siding and the main lines. The slabs were then pushed along to their final position and the load transferred to them by blocking and timbers under the tracks. The slabs all being in place, the joints were grouted ready for waterproofing. The concrete throughout the work was proportioned one of cement to six of aggregate.

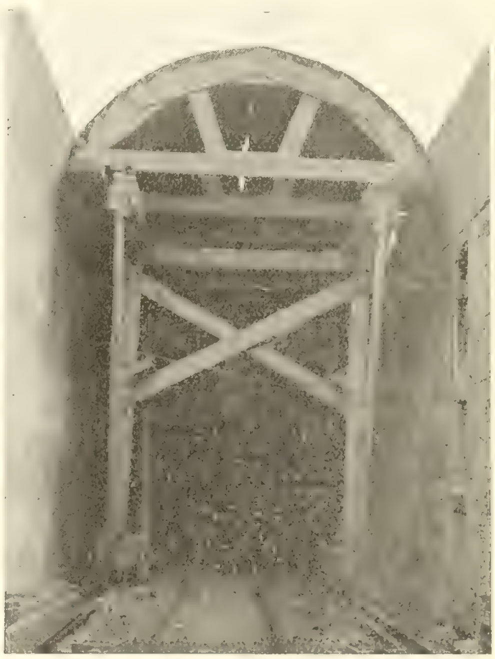

Fig. 4—Portable forms and form carriage for open cut section.

Open Cut Section

For a short distance east of the Portal station the excavation for the tunnel was made in open cut, on account of the small depth of cover and the character of the ground. The concrete tunnel lining being built in this cut conforms to the section shown in Fig. 3. After this is completed the hole will be filled in again and the streets of the Mount Royal Heights subdivision built on the surface. The method of constructing the lining has been to place forms for the side walls to a height of about one foot above the springing line for the arch. After these walls were set and the forms were removed the crown was built in short sections, using a portable form (see Fig. 4) supported on a form carriage running on a special track of 8-ft. gauge. The forms were blocked up on the carriage to their correct position, and when the concrete was set the blocking was knocked out and the forms lowered into the carriage and moved to their next position. The concrete for this portion of the work is made in a Ransome mixer with a capacity of 1 cu. yd. The arch is designed to withstand the full pressure of the earth between the roof and the surface, together with the live load which may be transmitted from heavy vehicles on the surface.

Shovel Excavation

The preliminary excavation of the tunnel having been carried out by means of headings and break-ups, the two side benches, containing about 8 or 9 cu. yds. of rock to a lineal foot, are being excavated by means of a Marion steam shovel with a 1¼-yd. dipper (see Fig. 5). This shovel is operated by compressed air supplied from the compressor plant. In order that its work may be continuous and free from interruption due to blasting, etc., the benches are drilled and blasted into for some considerable distance ahead of the shovel. The rock is loaded into muck cars on the 3-ft. gauge work track, and hauled to the portal by 10-ton electric locomotives. The rock is passed through the crusher plant at the west portal, and distributed into the bins and stock piles (Fig. 6) for use in building the streets of the Model City and for concrete work within the tunnel.

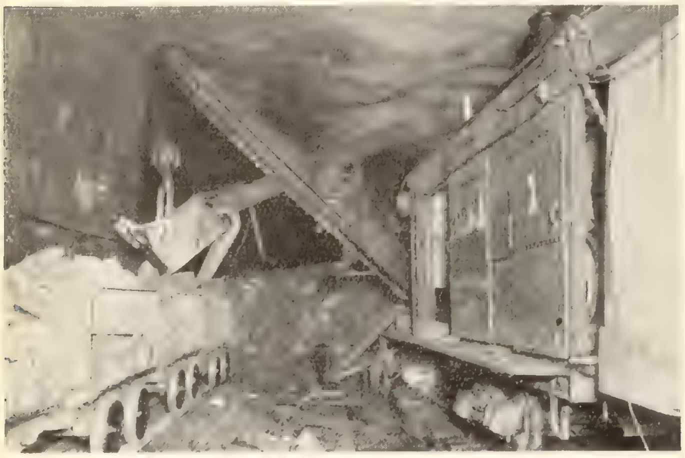

Fig. 5—Marion steam shovel at work removing benches.

An interesting piece of legislation has just been passed by the province of New Brunswick. This is an Act for the prevention of smoke and noises in towns and cities. The Act gives local authorities permission to make by-laws regulating or prohibiting the ringing of bells, the blowing of whistles, and the emission of smoke from chimneys. The maximum penalty is a hundred dollars.

Moving a Steel Water Tower

Contributed by C. E. Henderson, City Engineer's Department, Port Arthur, Ont.

RECENTLY the Ogilvie Flour Milling Company, Limited, who have a large flour milling and elevator plant in Fort William, found it necessary either to remove to a new site or tear down and reconstruct their water tower and tank, on account of the 250,000-bushel addition to their elevator which was under construction by Messrs. Barnett, McQueen Company, elevator contractors, of Fort William. They chose to remove the tower intact, and the steel tower, 120 feet high, supporting a 50,000-gallon water tank, was successfully moved a distance of two hundred feet by Messrs. Beaton & McLeod, contractors, Fort William.

The new concrete foundations were first constructed at the new site before the work of removing the tower was commenced. On account of the value of the tower and nearby buildings and the large force of men working on the elevator addition, it was necessary, before the old anchor bolts were loosened, to secure the tower against tipping over. To do this the top of the tower was anchored in four directions by ¾-in. steel cable. As the tower was moved the cable was carefully played out, or taken up, by means of a set of falls at the lower end of each guy. The feed pipe and frost box in the centre of the tower were supported securely by means of cross timbers between posts, and also by means of cables swung underneath the timbers at the centre and attached to the posts at a higher point.

The four posts of the tower, which were thirty feet apart on each side at the base, were made up of two channels each. To these posts were bolted 8 x 16-in. timbers, forty feet long, which were used in jacking up the tower before placing the skids and rollers under it. The track was composed of 12 x 12-in. timbers placed on the frozen ground and carefully levelled up with blocks. The skids placed under the tower posts were two 8 x 14-in. timbers, forty feet long, each having two maple shoes, 3 x 12-14 feet. The rollers were of

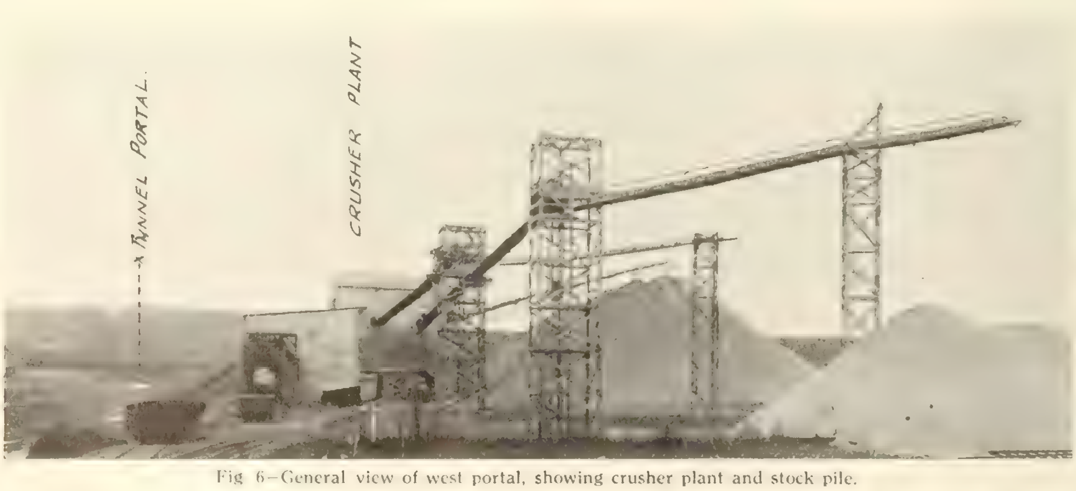

Fig 6—General view of west portal, showing crusher plant and stock pile.

maple, seven inches in diameter and six feet long. Transverse timbers, 8 x 14 ins., were used to keep the tower posts from spreading.

Power for hauling was furnished by a team attached to a ⅞-in. rope, which worked through a pair of double blocks. This tackle was used as a luff on the main ¾-in. steel cable, which worked through a pair of triple blocks.

Seven men were employed, and the entire operation, excepting the construction of the new foundation, required about five days. The actual time of moving, however, was only three and one-half hours.

Arrangement of Scow Bridge for Building Falcon River Dike, Winnipeg Water District

REFERRING to the description of Cook Construction Company & Wheaton Bros.' method of building a rock-fill breakwater at Halifax by using a dumping bridge whose outer end is supported on a scow, M. V. Sauer mentions that the same method was used in the Winnipeg Water District to build a diversion dike on Falcon River. The distinctive feature of the Halifax case, however, was the use of the dumping-bridge-and-scow method in tidal water. This required that the scow be arranged with ballast compartments and pumps, so that it could be kept at the same height with respect to the breakwater as the tide rose and fell. The Halifax contractors worked in a 6-ft. tide with no trouble by this method. At Winnipeg there was no tide to complicate the problem.

The details of the Winnipeg arrangement are interesting. When bids were called for, the engineers of the water district suggested that the scow method be used; nevertheless, all bidders but one figured on dumping from a trestle. Tomlinson & Fleming, the successful bidders, saved over $25,000 to the district by using the scow method.

The contractors used two scows in tandem. The track on the boats consisted of 90-lb. rails on a framework whose sills rested on, but were not fastened to, the deck. To move forward, the scows were outhauled under the rail-supporting frames by a cable passing forward over a snatchblock at the outer end of the rail and back to the dinkey. Then the inshore ends of the 90-lb. rails were moved to the outer end of the scows in the new position, and the gap filled in with the regular 60-lb. rail as used in the rest of the supply track on the finished fill.

The dike, 8,000 ft. long, containing about 230,000 cu. yds. of gravel, progressed rapidly, being practically completed in four months. The greatest depth of water was about 25 ft. Material was obtained from a gravel pit adjacent to the north end of the dike.—Engineering News.

One of the stands at the Chicago Cement Show this year contained some particularly interesting exhibits illustrating the durability of concrete. The most remarkable among these were sections of concrete from the ancient Roman cities of Pompeii, Rome and Colon. A piece of concrete cut from a bridge pier in Nova Scotia, and subject to continuous tidal action ever since the year 1884, showed how well concrete is able to withstand the most trying conditions. Another exhibit consisted of a piece of concrete sewer pipe 45 years old, taken from the Bay City sewer, Michigan, in the course of recent extensions. Other specimens of similar character were a 47-year old piece of sewer pipe from South Bend, Indiana, and part of a street crossing laid in North Dakota, fifty-one years ago.

Carrying a Sewer Beneath a Canal Embankment

To carry a sewer beneath a canal embankment which rested on running sand at Rochdale, England, the invert of an existing culvert beneath the canal was replaced by a hollow cast-iron invert which has since served as a sewer. The culvert was of elliptical section, 8¾ ft. high by 7½ ft. wide, "formed of four half-brick rings," to quote from the London "Surveyor." The hollow cast-iron invert blocks were made of a special form, equal in sectional area to a 24-in. circular pipe. Each 2-ft. length of block weighed about 1,400 lbs. To give a solid foundation to the cast-iron invert sewer, as it may be termed, "finely ground liquid lias lime grout" under air pressures up to 60 lb. was forced into the sand through holes drilled in the brick invert of the culvert. After allowing time for the grout to set, the brick invert was cut out in lengths not exceeding 2½ ft. A few inches in depth of the grouted sand were then replaced by "fine cement concrete," shaped by means of a template and rammed down. The hollow invert blocks were then placed. The spaces between the iron block and the remaining portions of the brick invert were filled with a 1:1 stiff cement mortar and calked with an iron tool, as were also the V-shaped joints between the ends of the iron castings—the faces of the latter having been planed and fitted.

Suggestions for Constructing Street Railway Tracks

IN the concreting of modern street railway track construction steam cinders make a good, cheap concrete with a 1:3:6 mix, but too often it is necessary to use more sand and cement, reducing the proportions to 1:2:4, on account of the quality of the cinders, writes S. Gausmann in The Engineering Record. Unless these cinders are obtained free, the cost of the concrete will be nearly as much as if gravel or stone is used, and yet it will be inferior in quality to mixtures containing the latter elements. A 1:3:6 mixture containing either stone or washed gravel, preferably the latter, is most desirable in modern track construction.

One of the causes of failures in paving is that when the concrete is placed in the track it is often too wet, thereby undermining the bed of the ties and causing the track to "pump." Concrete with an excess of water should be avoided, especially where operation is resumed over track immediately after the concreting is finished and before it has had time to set.

Another condition to be avoided is the failure to compact the concrete thoroughly under the rail. While with an exceedingly wet concrete this space will be filled at first, the concrete will soon shrink away from the rail, leaving a void which is not large in extent, but large enough to do damage. On the other hand, when the concrete is of the proper consistency a large pocket will be left unless extreme care is used. To avoid this trouble the concrete should be thoroughly placed by shovel tamping, followed, after it has set slightly, by tamping with tamping bars from both sides of rail. Unless this is done sand from below the paving will work into the pocket and cause the pavement to settle, especially along the rail.

When track is concreted from the bottom of the ties to 3 ins. or more above the ties it is advisable to do so in two sections, bringing the first section to the top of the ties, and placing on this a very thin layer of sand, followed by the rest of the concrete. While this separation may seem to be added work it can be done at no greater expense than if the concrete was placed all at once; it will not injure the quality of the foundation, and although the "other fellow" possibly is not considered the two-section practice means much good to the road when reconstruction is undertaken.

The Human Element in Contracting

By L. C. Watson[†]

AFTER learning that there is a prospective job, a member of the company investigates its character and location, to determine whether it is within the company's specialized work, and whether it is desirable. He then meets the owner, if possible, to interest him and to size up his temperament and business methods.

The Owner

As sometimes the owner takes an active interest in the execution of the work, although he deals through his engineer or architect, it is of considerable importance to know his temperament and point of view. Greater harmony will thus be obtained. The engineer will do well to bring both parties together early and often. There is the owner who has not been seen at the time of final payment, and there is the one who is in evidence every day; there is the one who has a technical training and knows, and there is the one who does not know about construction, but thinks he does, and personally mixes into the work commonly considered as the engineer's. If the engineer is weak-kneed with the last type of owner, expense and misunderstanding are almost certain to result—primarily because no man can serve two masters, and secondarily because an ignorant master, the owner, is never satisfied. If there is a strong, fair-minded engineer who commands the respect of his client, there is little trouble with any type of owner.

It is necessary to study the engineer or architect, and consider his method of handling and supervising work. The methods of some engineers are radically different from those of others, and this has a marked bearing upon the cost of the work, and sometimes on its desirability to the contractor. The contractor must determine what sort of treatment he will receive. Nothing adds to the price of a bid like uncertainty, whether it be in the temperament of engineer and owner or in unknown construction problems.

In one case where a number of local firms were invited to bid on a certain large building for an architect who was well known always to rule in favor of his client, irrespective of the merits of the case, the successful bidder, after figuring full measure on all quantities, added this item—"Humor architect." The item was 10 per cent. of the contract. It is safe to presume that all other competitors placed this contingency at a higher figure. Such a man could not get a reasonable bid from anyone who knew him, and certainly he could not expect to let work advantageously to guileless strangers. An engineer in a distant city, whose reputation has reached beyond the limits of his activities, has a personal equation of 25 per cent. plus. The best information available indicates that these men do not personally profit in any way improperly in this excess cost. Instead of being wise and just judges between the two contracting parties, they are simply over-zealous partisans. Fortunately, this class of architect and engineer is very small, and their influence on industry still smaller.

The largest class is that in which the engineer or architect intends always to be just, but on rare occasions allows his judgment to be influenced by the attitude of the owner; or, where two different solutions may be possible, for policy's sake or for hope of personal advancement, makes the second best decision. This increased expense which is entailed can never be foreseen, although it certainly exists, and has to be paid for as a contingent item of cost. The reputation of the engineer who is always fair spreads far and wide, and he is sought out by many responsible contractors who desire to do his work. This results in work being done at the lowest legitimate cost by competent firms. The owner gets a square deal and recommends his friends to employ this engineer, who in the long run prospers more than he could by other methods. Meanwhile, he maintains his self-respect and is proud of work well done.

Contractors talk rather freely among themselves about their experiences and their opinion of those for whom they have worked; and, perhaps oftener than is imagined, they are asked by owners whom they would recommend to design new work. Certainly they exert an influence on the reputation and on the business of the engineer.

American Engineers in Charge of Belgian Relief Work

TWO American engineers are mainly responsible for the efficient manner in which the Belgian relief work has been carried on. One of them, Lindon W. Bates, had retired from active practice after more than thirty years of engineering work, but willingly returned to labor nineteen hours a day without compensation as Vice-Chairman of the Commission for Relief in Belgium in organizing the work in the United States. The other, Herbert C. Hoover, stopped short in a noteworthy career to act as Chairman of the Commission, handling the work of distribution in the afflicted country.

Despite the fact that in the beginning it was emergency work, undertaken under most adverse conditions, there has been no hitch in the arrangements from the very beginning until the present, when the work is being carried along in almost machine-like fashion. A populous nation has been clothed and fed, largely by voluntary subscription. The innumerable small packages that had to be collected, transported and distributed can scarcely be imagined, and the countless details of arrangement and organization that had to be perfected to do it can hardly be visualized, for, it must be remembered, the donations came from all parts of this country, from the smallest hamlets and from the largest cities. Over five million dollars have been paid out from the New York office in cash, or check, each month, totalling at the present time over $40,000,000.

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[*] Extract from a paper read before The Boston Society of Civil Engineers.

[†] President Aberthaw Construction Company, Boston, Mass.

Deterioration and Decay in Timber

How Rotting Wood Has Endangered Various Forms of Construction in Canadian Practice—An Interesting Discussion at Montreal

DECAY in Timber was the subject of a discussion at the closing meeting of the Canadian Society of Civil Engineers, Montreal, on April 22. The subject was discussed from the engineering, botanical, chemical, biological, and other viewpoints by several speakers, their remarks being illustrated by a large number of lantern slides, showing the causes and effects of various forms of dry rot. The attendance was large, and included several prominent local architects, chemists and builders, and many consulting engineers.

The discussion was opened by Mr. Frederick B. Brown, M. Sc., M. Can. Soc. C. E., who said, in part:

During the last three or four years there have come into more or less prominence a comparatively large number of cases of decay in timber, causing structural difficulties. Timber is and will continue to be used in engineering work to such a very great extent for poles, piles, ties, cribwork, trestles, flooring, sheeting, and for the framework of buildings and other structures, that these cases of dry rot trouble seem to call for careful thought on the subject. Every engineer who has been connected with railroad work and pole line construction knows the effect of decay on ties, on the butts of poles and on other timbers partly embedded in the ground. But it is not so well known why adjacent ties or poles may act quite differently in resisting decay. The details of decay in buildings, however, are perhaps not so familiar to us as engineers, and it is therefore the purpose of this talk to present some features in connection with dry rot in buildings.

Decay in wood was supposed formerly to be a slow chemical action something like the rusting of metals, and it was thought that the fungus growths frequently found on timber were there because the wood was already decayed rather than because they were actually the cause of the rot in the wood. Forty or fifty years ago careful investigation in Europe showed that fungi were the cause of rot instead of the result of it, and the mycelium, or thread-like branches of the fungus, was shown to be capable of penetrating and destroying the wood fibre. There are several fungi which may cause rot in timber. Some of these varieties are now well known to botanists, but others are much less so. The action of the same fungus on different woods, and of different fungi on the same wood, is only commencing to be studied, but it is known that the same fungus acts very differently on different woods—and, indeed, on different parts of the same piece of timber. In addition to the life progress of the fungus through the wood cells, it is quite likely that there is a chemical action, but this is by no means well understood yet.

The pines—white, red and yellow—are the timbers most usually found in the framework of eastern mill and factory buildings. Spruce and hemlock also are used very largely, but not to such a great extent as the others, and oak beams have been used very freely in the past. The use of British Columbia or Douglas fir for framework is really only commencing in the east, but it is probable that this magnificent wood will be used more freely in the future, especially when the advantages of the water-borne freight via the Panama Canal shall have become well known. A very common form of construction is a framework of yellow pine with floors of spruce. The most noteworthy cases of dry rot in the last few years are concerned with timbers of nearly every variety mentioned. Apparently the disease is no respector of species. Neither is its action confined to any one locality: serious cases are on record in widely scattered places in Canada and the United States.

Structural Defects and Rot

Some four or five years ago we had occasion to examine nearly two score of water-tank structures in and around Montreal with a view to reporting on their stability. It may surprise some of those present to hear that in nearly every instance there were found one or more serious defects in design, construction or condition. Apart from structural defects, we found several more or less affected by rot.

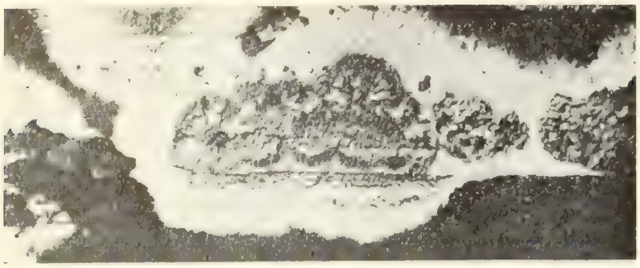
One case will serve as an example. In this one the entire wooden supporting framework was badly rotted and so dangerous as to require complete renewal. The arrangement of the structure was such that it was exposed to moisture most of the time, and an ample supply of condensed steam was available for the rot, which had penetrated nearly every member. This structure was composed of heavy white pine timbers. A not uncommon trouble was found in tank staves. These are generally of 3-in. stock. The heart of staves may be completely rotten without there being any external indication of such a condition.

A Montreal Factory

An interesting case has just come to our attention. A large factory built in 1911 near Montreal has recently been awarded a contract for the manufacture of shells for the war. In examining the building with a view to remodelling it to take certain new machinery it was noticed that the main floor had sagged. Investigation showed a serious case of dry rot, with extensive structural damage. The floor was composed of three thicknesses of 2-inch hemlock planks laid criss-cross, and the beams were 12-in. x 12-in. composite members made up of 2-in. x 12-in. hemlock planks spiked together. The floor was laid from two to four feet above the bare ground, and the beams were supported on concrete posts. There was no covering over the ground beneath the floor, nor were any openings provided. The entire floor and the beams were rotted, and were replaced by concrete.

Another case is that of a mill building. The main mill is a brick building with wooden framework, floors and roof. Taking a typical cross-section of the factory, we have a building five storeys high, about eighty-five feet wide, and about two hundred and fifty feet long. It is divided crosswise into four bays, separated by three rows of columns set about 21 feet apart. On the columns were set 8-in. x 18-in. yellow pine beams in pairs, except in the top storey, where the beams supporting the roof were single and were 8-in. x 16-in. in section. Each pair of beams was made up of two 8-in. x 18-in. yellow pine sticks held 1-in. apart by means of white pine spacers. The beams were fastened together by iron bolts passing through both beams and the spacers.

The columns in the factory were of cast iron in the first or ground storey. In the second, third, fourth and fifth storeys the columns were of yellow pine, square in section, and bored down the centre. In the second storey they measured 13¼ inches square, while in the three upper flats they were 11¼ inches, 9½ inches and 7¼ inches square, respectively. The flooring itself is the usual form of composite mill construction, made up of 2-in. x 5-in. spruce, set on edge, and of random lengths spiked side by side, running at right angles to the beams. The floors are finished on top over a layer of tar paper with 1-inch spruce on which is a hardwood wearing surface. There were twenty-one bents in the building, giving a total of two hundred and fifty-two wooden columns and seven hundred and fifty-six beams. All the timber beams and columns had been covered with a white linseed oil paint on the exposed faces.


Merulius lachrymans, or dry rot, with fruit, on beam removed from cotton factory. Scale one-third natural size.

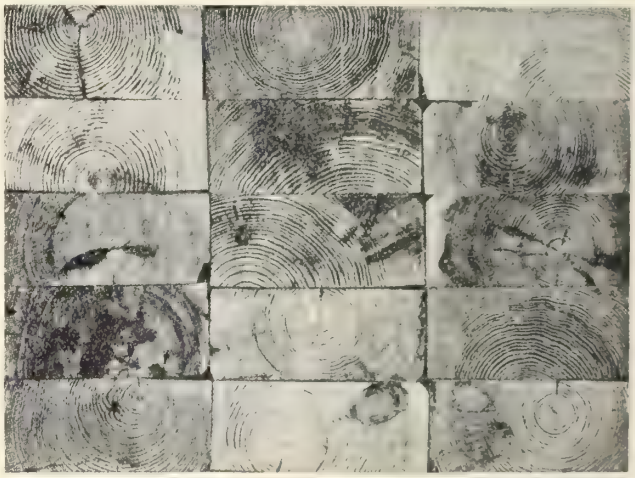
The first manifestations of rot were noticed about two years after the completion of the building in the sagging of floors, necessitating the shimming up of certain machines. An increase in the deflection in certain parts of the building was noticed, and a careful examination was instituted. It was found that a great many of the beams showed evidences of failures. It was considered wise to put in temporary posts here and there in order to reinforce the beams, and some of these were installed at once. In all, about three hundred and thirty temporary wooden posts were required within the ensuing twelve months, and the subsequent reconstruction of the building showed these temporary columns to have been essential to the safety of the structure while in use. Indeed, had it not been for the peculiar continuity and pliability of the mill construction floors, it is quite possible that accidents might have occurred even with this large number of temporary posts. The complete framework of the mill was removed and replaced with other material. During reconstruction careful notes were taken by inspectors, who were continuously on the work day and night.

Various degrees of deterioration were found; all the way from a trace of the fungus mycelium to what might be termed complete disintegration of the member. A great many of the beams were decayed so far that they fell into pieces in the process of being removed. Some were rotten to the core, and so much affected that with a crowbar or peavy one could readily break the beam into small pieces. It is doubtful if five per cent. of the whole number of timbers in the building were free from infection at the time of reconstruction.

The mill construction floors over the beams were affected also to a slight extent, but the results were not sufficiently serious to prevent them from performing their duty, and they were not removed. It is evident that in this case the resistance of the spruce floors to the attack of the fungi present was greater than that of the pine beams and columns, and the reason for this has been investigated. It is possible that the balance point of spruce with regard to relative humidity is different from that of yellow pine. When the shipment of yellow pine was delivered the remark was made by those handling it that it was as fine a shipment in appearance as any they had seen. After the completion of the mill any engineer or architect walking through the building undoubtedly would have pronounced it an eminently fine structure; yet within three years the entire framework of this building required renewal.

As a result of our study the conclusion was reached that the timber must have been affected prior to being placed in the structure. The use to which the building was put did not have anything to do with the ultimate result. Other mills have the same form of construction, and being operated in the same way have been in service for decades.

In discussing the timber specifications with dealers and others there appeared to be a difference of opinion as to the exact characteristics of the lumber which should have been supplied. This discussion led to a special study being made of the re-grading of yellow pine lumber. There are two main considerations in drawing up a specification for timber: one is durability, and the other structural strength. A piece of timber may have the necessary structural strength and have very little durability. In drawing up specifications where durability is of prime importance it is necessary, therefore, to choose between having high-grade timber and paying for the treatment of an inferior quality of stock. Where structural strength is of prime importance the choice lies between high-grade timber of a certain size and a large quantity of timber of a lower grading.


Part of 750 8" x 18" beams removed from a new factory in Montreal, after only three years' service. Rendered unsafe by decay.

The ordinary gradings in use up to a year or so ago apparently did not take into consideration all the factors necessary for durability and strength. The gradings for yellow pine were designed, seemingly, to meet the requirements of the lumber dealers. During the last year, two or three specifications have appeared which indicate that the requirements of the user as to durability and strength can be met.

Our researches convinced us of the necessity for describing timbers on a different basis from that formerly in use. We found what appeared to be a somewhat definite relation between certain of the physical characteristics of the beams and columns in this mill with regard to resistance to decay. The timber varied from very coarse-grained, having as few as three growth rings to a lineal inch measured along the radius of the section, to fine-grained beams having as many as twenty rings to the inch. The finer grained beams generally showed a higher resistance to decay than the coarse-grained, but this was not so universally. In some cases the fine-grained beams had a comparatively small percentage of dark summer wood, and these were more affected than a highly resinous, coarser-grained piece. Sapwood was found to be very susceptible to rot, but on the other hand heart wood was not entirely immune. Summing up all of the data we were able to collect, we concluded that the rosin content has a great deal to do with the resisting power of yellow pine. Generally speaking, those sticks which were dense and showed evidences of considerable rosin were much more resistant to the fungus attack than the lighter wood, even if fine-grained.

Oak columns and white pine floor beams removed from an entire floor of a factory in Ontario and replaced by steel after twenty-five years' service. Infection was introduced recently in new lumber used for a basement floor.

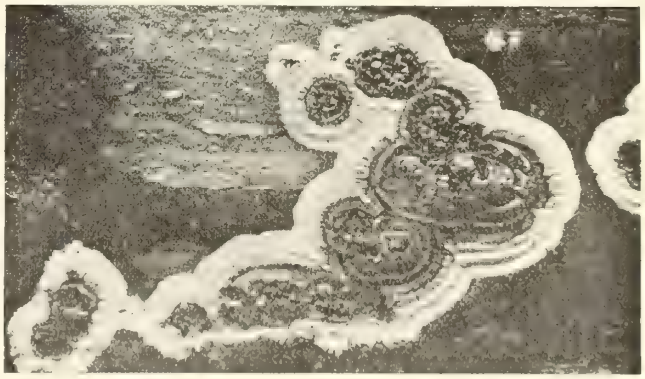
Dr. Carrie Derick, of McGill University, dealt fully with the botanical and biological sides of the question, explaining the structure of the woods, the various forms of fungi, and how the fungi affected different kinds of timber. Miss Derick also explained the methods by which the fungi spread, and the liking of certain species for various food materials. Good lumber used under proper conditions was an excellent building material, but it was perfectly useless to use poor lumber under circumstances where it was subjected to great strains.

Mr. F. J. Hoxie, Engineer and Special Inspector of the Associated Factory Mutual Fire Insurance Companies, Boston, remarked upon the stress some people laid upon ventilation in regard to dry rot. He pointed out, however, that it all depended upon the kind of ventilation, and that in some instances ventilation had encouraged, instead of retarded, the growth of fungi. Air taken from near the surface of warm, moist ground into a cool basement would prove worse than useless, as water would be precipitated from it on to the cooler woodwork, making it wetter instead of drier. Mr. Hoxie emphasized the importance of relative humidity in its relation to the growth of rot, and then alluded to the question of piling. He showed a picture of a Canadian lumber yard where the manufacturer used concrete bottoms for piling lumber; some lumbermen, he said, were under the impression that any old lumber was good enough for use in piling, and this was the cause of a considerable amount of infection. Other pictures illustrated tanks for treating lumber before piling, a method which had been proved to be effective. The percentage of rosin and the density were most important indices to the resisting power to decay in yellow pine. Mr. Hoxie concluded by pointing out the danger of using unsuitable lumber in mill construction.

Dr. J. S. Bates, Superintendent of the Forest Products Laboratories of Canada, stated that the laboratories had recently undertaken a general investigation of Nova Scotia mine timber. They had received from mine owners shipments of timber with a view to determine the relative strength of the various species; specimens of black and red spruce and balsam fir were obtained. When they started to make the tests it was found that the timber was infected with fungi, which of course affected the strength of the timber; the results showed that only forty per cent. of the 288 sticks were sound. Some mine owners wondered why the timber rotted so quickly; the investigation showed that some of the timber was rotting before it was put into the mines. As the result of the tests, it was found that the strength of the timber had decreased from 15 per cent. to 30 per cent., even with very little external sign of rot. With regard to the species, there was little difference so far as the deterioration was concerned. Enquiries elicited the fact that some of the pit props were not properly stored in the yards, and that they had absorbed a large quantity of moisture; there was also a considerable amount of rotten wood in the storage yard, which afforded excellent food for the fungi. Dr. Bates announced that the Department were undertaking experiments to determine the relation between moisture in lumber and the pressure of humidity in the surrounding air.

Mr. J. A. Jamieson referred to decay in timbers used in building grain elevators. His experience was that wood cut and placed in buildings in a very damp condition decayed rapidly; while in one case wood left to dry for twelve months was in an almost perfect condition after having been in use for twenty-five years. He asked how it was that in some instances the decay was found in the heart of the timber while the outside was sound?

Miss Derick replied that some trees were infected by reason of the wounds made through the branches being broken, allowing fungi to enter the heart, and still other timber was infected after it was cut, since in some species heartwood is more susceptible than the outer portions of the tree.



Coniophora, with fruit, on a beam removed from a cotton factory. Scale one-third natural size.

Dr. Porter, of McGill University, suggested that dry rot had increased of late years. He thought that this was due in part to the fact that years ago portable mills were more in use; now the establishment of large mills formed, as it were, fungus beds.

Mr. Hoxie was of opinion that the increase of rot cases was due to a certain extent to the kind of lumber which was now used. He pointed out that the supply of long leaf pine was not so reliable as it was in the past, and that loblolly, which formerly was rejected, was now being used in increasing quantities.

Dr. S. Kirsch also remarked that in Northern Quebec they formerly cut the best qualities of pine, but now the mills were shipping inferior grades. It was much more difficult to get good pine, and the shipping distances were greater.

Mr. John Kennedy, in moving a vote of thanks to the speakers, asked, "How shall we get good timber? We have to keep lumber in damp and hot places, and it is difficult to see a remedy." He hoped the investigations would result in a remedy being found for dry rot.

Mr. Walter J. Francis (the chairman), in closing the meeting, declared that wood was an excellent building material; probably 90 to 95 per cent. of the structures in which lumber was employed were satisfactory. Dry rot was very insidious in its operation, and the object of the discussion was to interest engineers in the subject, which was of growing importance.

The question of timber treatment was left for another meeting.

Suggested Specifications

It is of interest to note that Mr. F. J. Hoxie has recommended the following specification for adoption by The Associated Factory Mutual Fire Insurance Companies.

In making contracts for beams, columns and plank to be used in "Slow Burning Construction," the following specifications are recommended:

Density. No part of the material shall have a density of less than 30 pounds per cubic foot when tested by boring smooth holes one inch in diameter and two inches deep in the ends of the stick, drying to constant weight at 212 deg. F. and weighing the borings and computing the density from the volume of the hole.

Rosin. None of the heartwood shall show less than four per cent. of rosin by weight when borings are taken with a one-inch bit with a hole two inches deep, dried to constant weight at 212 deg. F. and extracted with benzole, the extracted rosin evaporated until it is not soft or sticky when touched with the finger at 70 deg. F.

Heartwood. Heartwood shall show in all four faces of every stick, and sapwood shall not extend more than two inches from the corner at any place, measured perpendicularly to the corner across the face.

Growth Rings. For timber 6-in. x 8-in. or larger, there must show on the cross section between the third and fourth inch, measured radially from the heart centre or pith, not less than six annual rings of growth, a majority of which shall show at least one-third summerwood, which is the dark portion of the annual rings; but wide ringed material excluded by this rule will be acceptable, providing that in the majority of the annual rings the dark ring is hard and in width equal to or greater than the adjacent light colored ring.

For pieces in which the centre is not included, there must show on the cross section, an average of not less than six annual rings of growth, with not less than one-third summerwood. Timbers will be rejected in which there is no sharp contrast in color between the springwood and summerwood.

Defects. No timber with knots greater than one inch in diameter, or rot, or injurious shakes will be accepted.

Branding. Longleaf pine sold under this specification shall be branded with the letters "F. M.," the name of the lumber manufacturer, the location of the sawmill from which it comes, and the date of sawing, in letters at least one inch high.

Accurate Daily and Total Cost Sheets for the Paving Contractor

By C. B. Montgomery

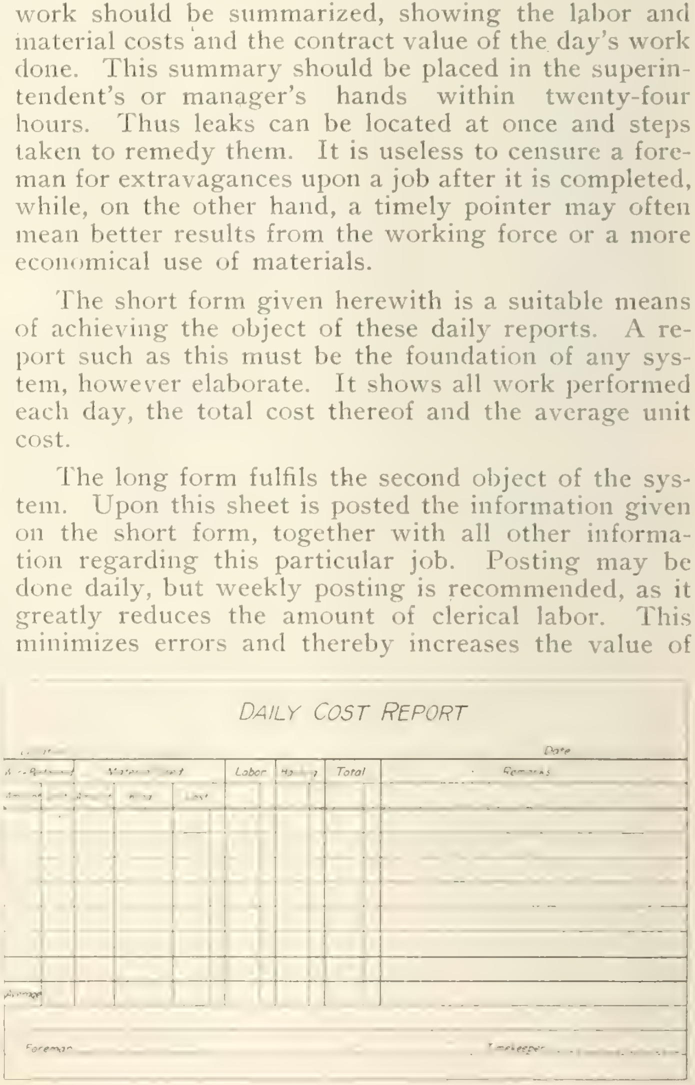
RELIABLE cost data serve two purposes for the paving contractor. First, immediate reports while the work is going on disclose leaks and inefficiencies that can be remedied with profit on the spot. Second, complete and accurately kept costs for one job furnish a basis for bidding rationally on the next one of a similar kind. This advantage is most pronounced in paving work, where similar conditions are met with again and again in the business of the same firm. It is also one which is too little realized, and seldom made use of by the average firm. A contractor will often merely ascertain the local prices of materials, estimate the labor requirements, add the conventional twenty per cent. for overhead, and then affix an item for profit determined largely by the amount of competition and the state of his exchequer.

Value of Daily Reports

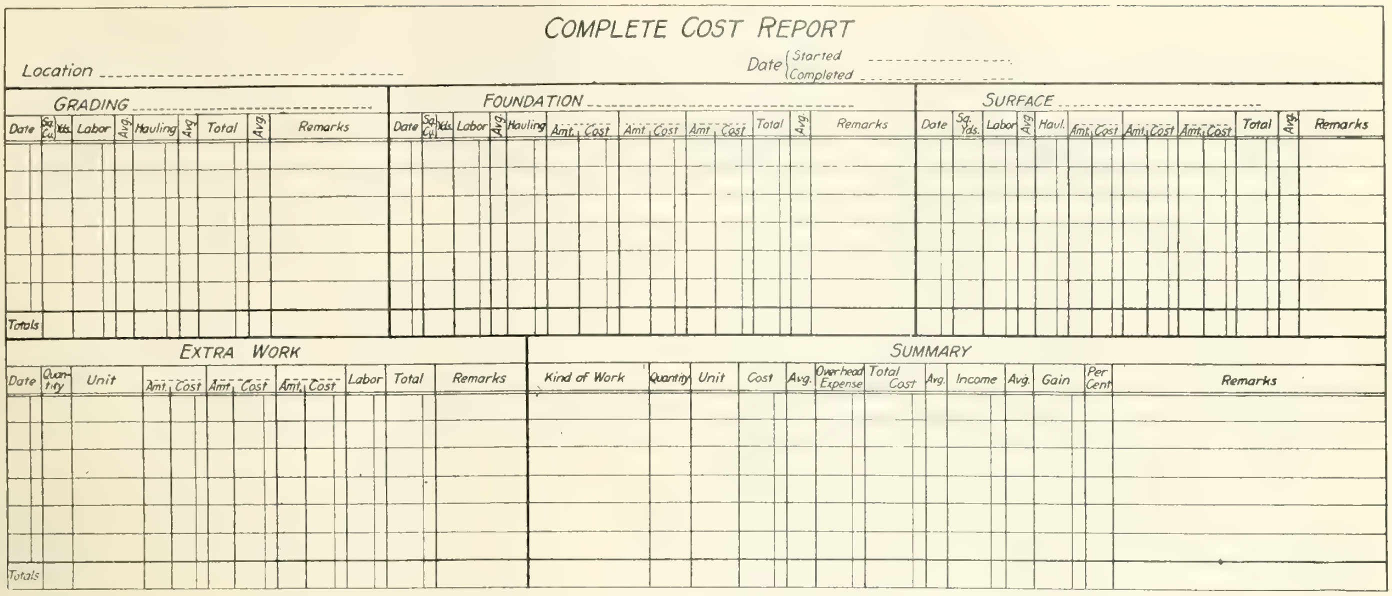
Often a contractor will make or lose large sums without knowing where or why it occurred, and without giving a thought to what changes are needed under the same conditions on another job. Each day's work should be summarized, showing the labor and material costs and the contract value of the day's work done. This summary should be placed in the superintendent's or manager's hands within twenty-four hours. Thus leaks can be located at once and steps taken to remedy them. It is useless to censure a foreman for extravagances upon a job after it is completed, while, on the other hand, a timely pointer may often mean better results from the working force or a more economical use of materials.

The short form given herewith is a suitable means of achieving the object of these daily reports. A report such as this must be the foundation of any system, however elaborate. It shows all work performed each day, the total cost thereof and the average unit cost.

The long form fulfils the second object of the system. Upon this sheet is posted the information given on the short form, together with all other information regarding this particular job. Posting may be done daily, but weekly posting is recommended, as it greatly reduces the amount of clerical labor. This minimizes errors and thereby increases the value of



Daily cost reports should reach the contractor within twenty-four hours.



COMPLETE COST REPORT

Location ________________ Date {Started ________ Completed ________

GRADING ________________

Date	Sq. Cu. Yds.	Labor	Avg.	Hauling	Avg.	Total	Avg.	Remarks
Totals								

FOUNDATION ________________

Date	Sq. Cu. Yds.	Labor	Avg.	Hauling	Amt.	Cost	Amt.	Cost	Amt.	Cost	Total	Avg.	Remarks

SURFACE ________________

Date	Sq. Yds.	Labor	Avg.	Haul.	Amt.	Cost	Amt.	Cost	Amt.	Cost	Total	Avg.	Remarks

EXTRA WORK

Date	Quantity	Unit	Amt.	Cost	Amt.	Cost	Amt.	Cost	Labor	Total	Remarks
Totals											

SUMMARY

Kind of Work	Quantity	Unit	Cost	Avg.	Overhead Expense	Total Cost	Avg.	Income	Avg.	Gain	Per Cent	Remarks

Daily costs should be posted weekly on this form and checked with payrolls and invoices for material.

the cost sheet. At the end of each week or pay period the total labor amount posted should be checked with the payroll for that period. In a similar manner all materials should be checked with the invoices received.

For preserving these reports, the short form may be filed under the foreman's name, keeping the latest dates on top. The long forms may be conveniently bound in a loose-leaf binder, the names of the streets or jobs being in alphabetical order. When a job is completed the sheets can be transferred to a permanent file.

The subject of overhead expense is so complex and extensive that it will be impossible to discuss it more than briefly. It is of great importance, however, and should be included in any complete cost report. The common items constituting overhead are rent, light, heat, insurance, officers' salaries, tools and equipment, interest and discounts, office stationery, etc. The usual method of distributing overhead to the contracts performed is the inaccurate one of totalling the entire cost of a year's work, totalling the overhead for that year, and proportioning the latter evenly over the work. This method is not only loose, but requires waiting until the end of a year to get the complete cost. A modification of it, however, may be made to give much quicker and better results.

All overhead charges should be grouped under subheads, such as office expenses, which should include the clerical force, stationery, telephones, rent, etc.; tools; machinery, including steam shovels, concrete mixers, rollers, etc.; plant, counting such charges as rent, insurance, plant machinery, etc. (this item applying particularly to asphalt paving concerns who maintain expensive plants); general expenses, covering officers' salaries, interest and discounts, bad debts, etc.; and any other subheads which may be necessary. Of these subheads, all but plant and machinery should be handled alike and can therefore be lumped and treated as one. The total of these subheads should be distributed over the work for the year in this manner. The total labor cost of all work for a year should be taken as a basis for pro-rating the overhead. The amount or cost of materials used is not a factor in distributing any kind of overhead expense.

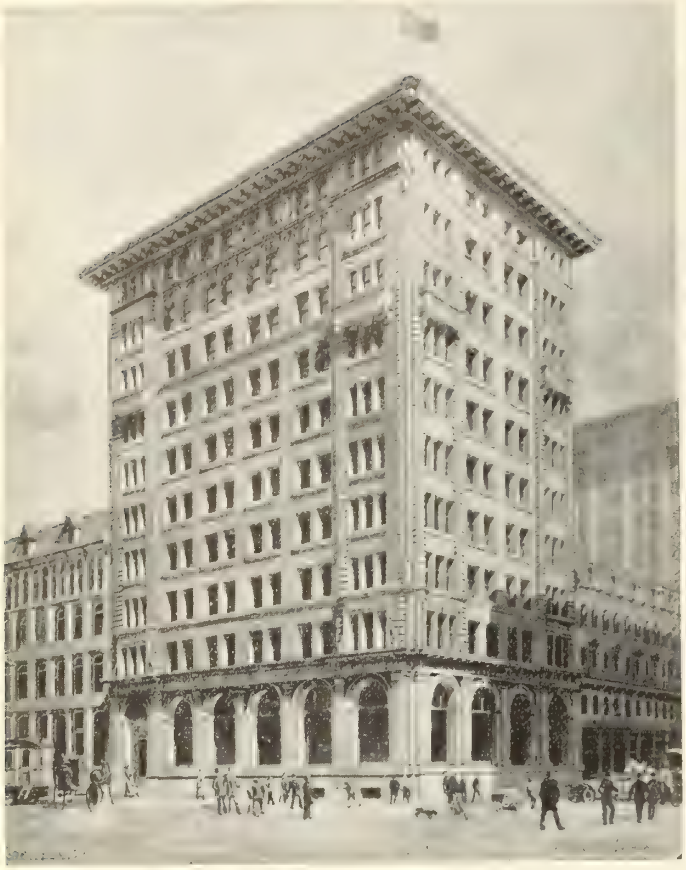
Expenses under the subhead plant are distributed only on the jobs which have received material from the plant. In the case of asphalt paving, the unit of production is the "box." The plant expenses for a year are divided by the number of boxes produced for that time and charged to the jobs where the material was delivered, in proportion to the quantities received by each. Machinery should, of course, be charged only to the work upon which it was used. The basis of division should be the number of days the machinery was in use.

It is desirable, as previously stated, to affix overhead charges immediately on completion of a piece of work, rather than to wait until the close of the fiscal year to determine the correct percentage. This should be done by using the percentages of the previous year. If, as is usually the case, conditions have changed, either by an increase or decrease in the volume of work done, or by an increase or decrease of overhead charges, the use of a previous year's percentage would result in a false showing which is not apparent until the close of a year's work. This difficulty is obviated by the method developed by the writer, of totalling and comparing the month's figures with the corresponding month of the previous year.

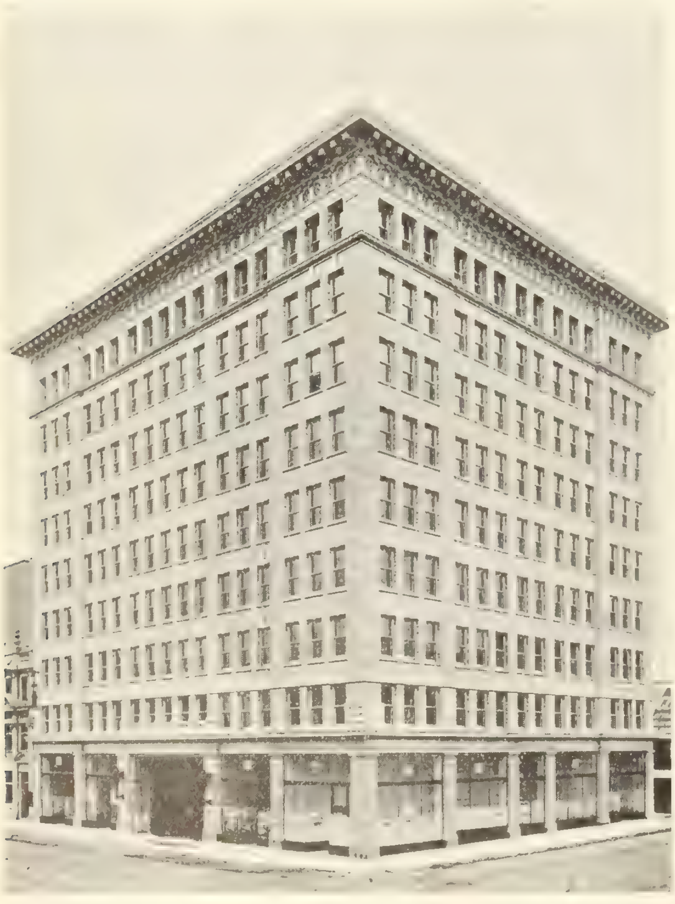
At the close of each month the figures for that month, both overhead and labor, are compared with the corresponding month of the previous year. The differences are added to or subtracted from the past year's totals. From these new totals a new percentage is obtained, to be used for that month's work.

For example, assume the total labor for the year 1914 to have been $25,600. The total overhead charges for the same year will be taken at $3,690, which means that the overhead charges for any given payroll should be 14.41 per cent. of the payroll. For the month of January, 1915, assume a labor cost of $6,440 as against $4,820 for January, 1914. This is an increase of $1,620, making a total for the year ending January 31, 1915, of $27,220. Assume also an overhead expense for January, 1915, of $1,800 as against $1,930 for January, 1914. This decrease of $130 gives a new overhead total estimated for the current year of $3,560. From these two new totals a new percentage of 13.08 is reached. Taking 13.08 per cent. of $6,440, we have the adjusted overhead charge for January, 1915, of $840.

Similarly, each month a new rate can be obtained which will change with changing conditions, and which will provide a more accurate figure than the method commonly in use.—Engineering Record.



The new Bank of Toronto at the corner of McGill and St. James Streets, Montreal.



The new McLeod Block at Edmonton, erected at a cost of $600,000.

The New Bank of Toronto at Montreal

ONE of the most important buildings erected in Montreal this year is the new Bank of Toronto, now being built at the corner of McGill and St. James Streets, by the Atlas Construction Company, from plans by Messrs. Hogle & Davis, Montreal. The Bank is on the site of the old premises and of some adjoining buildings on St. James Street. The area is 92 ft. x 64 ft., with an additional area of 40 ft. x 28 ft. at the rear. The building will consist of a basement and ten storeys.

The frame is of structural steel, with an exterior of polished granite base course, and above this terracotta. The floors will be of concrete, and the partitions will be fireproof. Each floor will have an area of approximately six thousand feet. Difficulties were encountered in the foundations, one-half of the ground being found unequal to the heavy load which it would have to bear. The Simplex Construction Company were called in, and placed one hundred and fifty standard Simplex piles. In our issue of November 18, 1914, we described in detail the methods by which these piles were placed.

The basement will contain the boilers, ventilating fans, and the Bank's vaults. The roofs of the latter will be of very heavy steel and reinforced concrete. The ground floor will be occupied by the Bank, the entrance being on St. James Street. On the east side of this floor will be three passenger elevators, supplied by the A. B. See Electric Elevator Company of Canada, Limited, Montreal. The Manager's and Assistant Manager's offices are placed facing the St. James Street elevation, while behind are the public hall and the various tellers', accountants', and clerks' offices. The remainder of the floors will consist of offices, finished in birch. The top floor is set aside for living rooms for the janitor, and a dining room for the staff. In the halls there will be marble dados four and a half feet high, while in the halls on the main floor the marble dados will be eight feet high.

A light-well will be situated in the rear portion of the building, the windows here being of metal. The following are the sub-contractors: steel frame, the Structural Steel Company, Limited, Montreal; heating, plumbing and ventilation, L. E. Moulton and Company, Limited, Montreal; electrical wiring, P. Lahee and Company, Montreal; granite, Stanstead Granite Quarries Company, Limited; terra-cotta, Atlantic Terra Cotta Company, New York; woodwork, Joseph Binnette, Montreal; hollow metal windows, A. B. Ormsby, Limited, Toronto; metal bank windows, H. Hope and Sons of Canada, Limited, Toronto; architectural iron work, Montreal Architectural Ironworks Company; glazing, Hobbs Manufacturing Company, Limited, Montreal; marble, Smith Marble and Construction Company, Limited, Montreal; roofing, Metal Shingle and Siding Company, Limited, Montreal.

A Pan-American Road Congress, under the joint auspices of the American Highway Association and the American Road Builders' Association, is to be held at San Francisco during the week beginning September 13. This date, which was decided on April 16 at a meeting of the joint committee representing the two associations, will enable engineers from the East to attend this Congress and also the International Engineering Congress which convenes the week following. Plans for the Congress are in charge of an executive committee, of which Hon. Chas. W. Gates, Governor of Vermont, is Chairman.

Method and Cost of Constructing Reinforced Concrete Drops on C.P.R. Irrigation Work*

THE Western Section of the Irrigation Block now being developed by the Department of Natural Resources of the Canadian Pacific Railway Company, has a large system of canals and ditches, the aggregate length of which is about 1,600 miles. There are a very large number of structures on the various canals and ditches. Some of the timber structures were built as early as 1905 and have been eight years in the ground. Most of these structures, especially the highway bridges and division gates, are good for a number of years yet, but some of the drops, of which there are a large number, are beginning to develop signs of weakness, and as they must be replaced without stopping the flow of water during the irrigation season, May 1 to October 1, the reconstruction must take place before or after the water season, or during that time by diverting the water around the structure by temporary works.

LABOR COST—DROP No. 2A—LANGDON DISTRICT.

Feature	Labor cost.	Unit cost.	Quantity and Unit		Remarks.
Moving camp	$ 68.00	......			About 16 miles
Setting up camp	19.55	......			About 24 men
Camp expenses	7.00	......			Dishes and repairs
Hauling supplies	159.30	......			Groceries, hay and oats
Excav. of by-pass	210.00	$ 0.139	1,507	cu. yds.	Clay loam
Excav. of old drop	1,250.00	0.636	1,967	cu. yds.	Hand work around old structure
Removal of old drop ...	126.80	2.338	54.243	M. ft. B. M.	Piling removed above grade
Building cement shed ...	8.96	8.070	1.112	M. ft. B. M.	Temporary structure
Building chute in by-pass	34.00	33.660	1.010	M. ft. B. M.	Drops water back into canal
Hauling lumber	46.60	1.987	23.438	M. ft. B. M.	Haul 2 miles
Hauling steel	4.10	0.031	129.96	cwt.	Haul 2 miles
Hauling cement	40.00	0.042	948.00	cwt.	Haul 2 miles
Hauling gravel	162.90	0.975	167	cu. yds.	Haul 2 miles
Hauling sand	72.00	1.060	68	cu. yds.	Haul 2 miles
Hauling sand and gravel .	88.60	2.685	33	cu. yds.	Haul 15 miles
Hauling mixer and pump	29.30	......			Haul 21 miles
Pumping water	13.10	......			
Building forms	591.00	0.100	5,929	sq. ft.	
Bending and placing steel and wire fabric	110.65	0.851	129.96	cwt.	
Mix. and placing concrete	336.10	1.680	200.00	cu. yds.	
Removal of forms	51.25	0.009	5,929	sq. ft.	
Backfilling by-pass	143.40	0.090	1,600	cu. yds.	
Backfilling drop	375.70	0.237	1,588	cu. yds.	
Removal of chute	6.88	6.812	1,010	M. ft. B. M.	
Repairs to bank	106.88	0.822	130	cu. yds.	
Riprap to bank	30.10	1.027	29.3	cu. yds.	Erosion by water from by-pass
Cleaning up, etc.	13.72	......			Extending 25 feet below drop
Total labor cost	$4,105.89		....	....	Includes team feed.

MATERIAL COST—DROP 2A—LANGDON DISTRICT

eature	Quantity	Cost	Freight	Total cost	Unit cost	Remarks
Reinforcing steel	11,921 lbs.	$229.72	$60.55	$290.27	$0.024	600 ⅝-in. and 300 ½-in. bars.
Wire fabric	1,075 s. f.	22.84	6.73	29.57	0.027	Clinton fabric
Cement	237 bbls.	482.86	45.75	528.61	2.230	Canada Cement Company.
Gravel	167 yds.	183.70	61.30	245.00	1.467	Calgary Sand & Gravel Co.
Sand	68 yds.	74.80	25.10	99.90	1.469	Calgary Sand & Gravel Co.
Lumber	23,438 ft. B. M.	323.94	54.80	290.13	12.380	Less $88.61 salvage value.
Rope repairs, etc.	....	44.35	.....	44.35	......	
Total material cost		$1,362.21	$254.23	$1,527.83	......	

Total labor cost, including team feed		$4,105.89
Total material cost		1,527.83
Depreciation on concrete mixer, pump, wagons, harness, horses, etc.	$302.44	
Depreciation on camp equipment	42.45	
		344.89
Overhead expense of superintendence, engineering, office work, accounting, etc.		938.00
		$6,916.61

The policy of the company has been to replace the large timber structures as they approached the end of their life with permanent concrete structures of approved design. The programme of betterments for 1913 included the replacement of the large timber holdup drop known as drop No. 2A in the Secondary "A" Canal, Langdon District, S. E. ¼ section 19-23-27. The new 10-ft. drop was designed to be built of reinforced concrete with a central pier and two openings that can be closed with stop plank 5 ft. 9 ins. long. The holdup feature of this drop is required to insure the delivery of water to "B" Distributary in Langdon district, which takes out 3 ft. above canal grade. The drop is designed to discharge 1,000 sec. ft. of water over the crest when the canal carries 8 ft. depth of water. Previous experience indicated the economy of diverting the water and building the drop during favorable weather, especially as rains and other conditions made it reasonably certain that a by-pass carrying 100 sec. ft. would satisfy the irrigation requirements. It was necessary, however, to carry 220 sec. ft. for a few days, which caused some additional bank erosion below the temporary drop. The construction crew was moved to the site July 17 to 19 and began the work of excavating the by-pass and building a diverting dam in the canal. The by-pass was completed July 29 and the work of tearing out the old timber drop commenced. The old structure was heavily built, having 2,200 lin. ft. of piling and 54,243 ft. B. M. of lumber incorporated in it. Certain timbers in the old drop proved to be pretty well-decayed, particularly above the water line. The piling behind the breast wall was rotted and constituted the weakest spot in the structure.

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* By Robert S. Stockton, in Engineering and Contracting.

The excavation disclosed 4 ft. of soil underlaid by a compact boulder clay which proved to be quite impervious, and after the footings and lower concrete floor were in place, there was no pumping required.

The nearest gravel pit was about 15 miles distant and 42 cu. yds. of unscreened material was hauled and used. The pit contains good sand but poor gravel, and when the cost of screening was added and quality considered, it was thought best to ship the larger part of the sand and gravel to Bennett Siding, about two miles from the work. The gravel received from the Calgary Sand & Gravel Company, however, had some oversize that was picked out by hand. The steel shipped to Bennett Siding was mixed up with steel for Strathmore, which necessitated a team haul to straighten out.

A carload of lumber was delivered at Bennett Siding for building the forms, chute, and cement shed, and 1,421 F.B.M. was hauled from Dalroy Watermaster's Headquarters. The carpenters started building forms on August 6 and the cut-off walls were poured on August 27. The last concrete was put in on September 20.

The general mixture was intended to be 1 sack of cement to 2½ cu. ft. of sand and 5 cu. ft. of gravel. For thin walls and copings a mixture of 1-2½-4 was used, and for the lip of the drop 2-2½-5. Since 948 sacks of cement were used, the average was 4.74 sacks per cubic yard of concrete. The concrete was mixed wet enough to spade, and was spaded so as to require little patching when the forms were removed. The concrete appears to be of excellent quality. The concrete was mixed with a No. 1 Smith Mixer, with steam engine, boiler and side loader mounted on steel trucks.

All labor was paid at prevailing rates, stated at so much per day of 10 hours. Every rate is stated in full and so carried in the time books with board deduction of $5.50 per week. The cost of team feed is taken at 90 cts. per day per team and pro-rated to all work on which team time is charged.

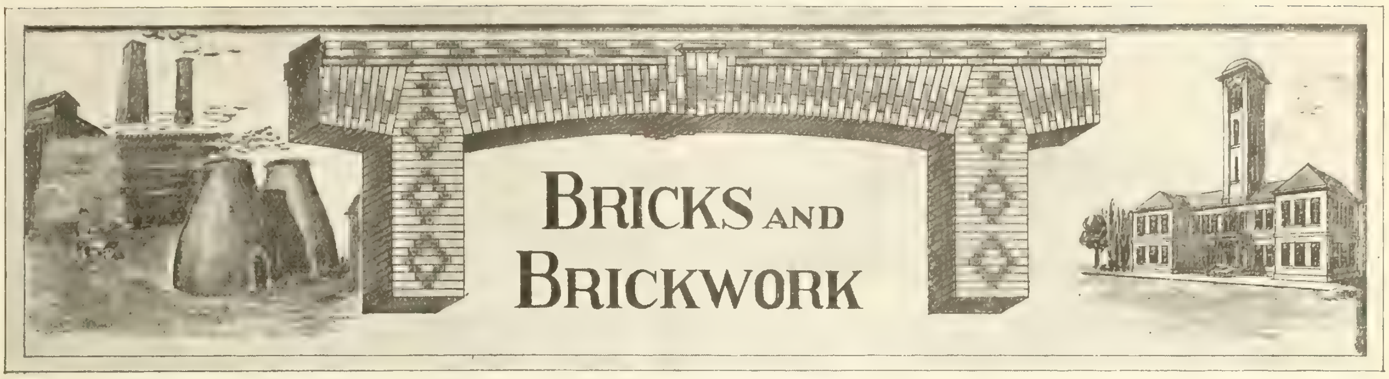
The wages of foreman, barn boss, and for Sunday time of teamsters were pro-rated to all labor items. Two rates of wages were paid, as it had been necessary to make a raise at harvest time to hold the men; even at the increased rate, considerable trouble was experienced, as farmers were then paying about $2.50 per day and board. The wages paid were as follows: laborers at $2.50 to $2.75 a day of 10 hours; teamsters at $2.10 to $2.35 a day of 10 hours, and including Sundays; carpenters at $3.50, $4 and $5 a day, and foreman at $120 a month. The foreman, Jack McMullen, ran the mixer when necessary. The work was directed by R. B. Stevens (Watermaster), and Mr. G. H. Patrick (Canal Superintendent), who reported to the Superintendent of Operation and Maintenance for the Western Section. The plans were furnished by the Chief Engineer, who is in general charge of operation, maintenance and construction for all the irrigation projects being developed by the Canadian Pacific Railway Company.

Summary of Feature Costs—Drop No. 2A—Langdon District, 1913.

Camp and supplies	$ 311.32	$ 1.560
Excavation and backfilling	2,085.98	10.430
Preparatory work	219.64	1.098
Hauling materials	414.20	2.071
Building forms	591.00	2.955
Bending and placing steel	110.65	0.554
Mixing and placing concrete	336.10	1.681
Removal of forms	51.25	0.257
Steel and wire fabric	319.84	1.595
Cement	528.61	2.643
Gravel and sand	344.90	1.725
Lumber	290.13	1.451
Riprap below drop	30.10	0.151
Depreciation	344.89	1.725
Overhead expense	938.00	4.690
	$6,916.61	$34.583
Camp and supplies and preparatory work	$ 530.96	$ 2.655
Excavation and backfilling	2,085.98	10.430
Concrete work	2,986.68	14.932
Riprap below drop	30.10	0.151
Depreciation	344.89	1.725
Overhead expense	938.00	4.690
	$6,916.61	$34.583

Electric motor omnibuses are being run by the city of York, England. The vehicle seats 22 passengers and weighs, with the storage battery, about 8,000 lbs. The battery used comprises 64 Edison cells, is placed under the seats, and has a capacity of 300-amp-hrs. at 72 volts. The omnibus can run at speeds from ten to twelve miles an hour and can make forty to forty-five miles before recharging. One advantage of the electric omnibus is that it requires so little attention from the driver that he is able to act as conductor as well as motorman. The entrance door is at the front, beside the driver's seat, and by running without a conductor the operating cost is greatly reduced.

The use of cement as an anti-sand blast is one deserving the attention of railway engineers. When locomotives stand under steel bridges or viaducts, the blast from the smoke shaft throws out gases and numerous small particles of ashes and coal, causing serious injury in course of time. In such cases cement has been successfully used, and now it is common practice on railways to cover the bottoms of bridges with reinforced concrete or cement mortar, which has been found to resist the attack of gases and also the blast of particles coming from the locomotives.



Review and Forecast of the Progress of the Burned Clay Industry in Eastern Canada

By Joseph Keele

THE present spell of growth and progress in Canada, beginning about ten years ago, found the native clayworking industry inadequate to supply the demand for building material. Consequently, such substitutes as concrete construction, sand-lime and cement brick, were largely used and a good deal of face-brick and fireproofing were imported from the United States. During the last three or four years several large plants have been erected in the vicinity of Toronto and Montreal for the manufacture of ordinary building brick. The output of these plants is now so large that there is no longer an excuse to use substitutes for brick, either on the score of price, quality, or promptness of delivery.

As competition in this field is bound to be keen, the future existence of the individual industries of this class will depend on their ability to produce the largest percentage of first quality brick per kiln, with the lowest cost of fuel and labor.

The recent great development of the industry in the area between Toronto and Hamilton was due to two conditions. The district contains an abundance of the best raw materials in Canada for the manufacture of rough clay products, and the two cities and neighboring towns offer a large market for the wares produced from them. The raw material used includes plastic shales from two formations—the Queenston and Lorraine, which are better known to clayworkers by their former names, Medina and Hudson River.

The soft, stoneless clays, of recent origin, are also more extensive in these localities than anywhere else in Ontario, except possibly in the clay belt of the northern portion of the province.

The Lorraine shale and stoneless brick clays of recent origin occur abundantly within easy reach of the city of Montreal, and these have been utilized freely in recent years in building up that city and its suburbs.

The city of Quebec is supplied with similar materials, conveniently situated. The first plant for the manufacture of shale brick was established near this city a few years ago. The products of this plant have been so satisfactory in every respect that a bright future is assured for it.

The city of Ottawa was dependent, until recently, upon the common brick made for surface clays in its vicinity. A few years ago an extensive plant was erected at Russel (about twenty miles distant) which utilized the Medina shale outcropping in that neighborhood. The greater part of the output goes to Ottawa. The Lorraine shales outcrop is in a large area just east of the city limits awaiting future developments. It is not utilized at present.

The Maritime Provinces possess the raw materials suitable for the manufacture of a greater range of clay products than is found in any other portion of Eastern Canada, but the surface clays are almost the only portion of their resources that are utilized at present. The principal brickmaking centres are at St. John, Pugwash and Annapolis, these points being selected on account of the raw materials available, and the facilities for distribution, both by land and water. The large plants which have been erected recently in these localities use the stoneless surface clays for brickmaking, while the large plants erected in the provinces of Ontario and Quebec use either of the two shale formations before mentioned.

Owing to their greater compressive strength, density and uniformity of size, the shale brick are preferred for underground work, such as trunk sewers, and for high structures carrying heavy floor loads. The future development of the brick industry, then, in the Maritime Provinces, will be in the utilization of the plastic shales with which they are bountifully supplied.

As far as the rough clay products industry in rural districts is concerned, there will be little or no change in the future as there has been in the past. The character of the product is fixed by tradition and usage, and by the raw material available at any given locality.

Any changes that are introduced will not affect the color and shape of the product, but will be manifested in improved or more economic method of production, such as the substitution of permanent down-draft kilns for the wasteful temporary scove or clamp kilns now in use.

One thing seems bound to happen, however, in this connection, and that is the extension of the practice of underground drainage for agricultural lands. This is done to a considerable extent already in Southern Ontario, but scarcely at all in Quebec or New Brunswick. No field drain-tile are produced in these two provinces, although they have extensive and widespread deposits of stoneless surface clays suitable for the purpose, as well as large regions of land which would be rendered much more productive by underdraining.

The development which is likely to occur, therefore, is the building of several small plants at various points, to which farmers from the surrounding districts can send their teams for a load of tile whenever required. This seems to be a more satisfactory plan than in having a few extensive tile works at certain centres, from which shipments would have to be made by railroad or barges to the rural districts.

The extensive belt of stoneless glacial clays in

Northern Ontario and Quebec contains material which is very suitable for the manufacturer of common-brick and drain-tile. These localities are situated too far from present markets to allow of their being worked for this purpose.

Owing to the abundance of wood in this region, brick and tile should be produced cheaply. A cheap freight rate to southern points might be secured by utilizing return empty coal cars from the divisional points on the Transcontinental Railway, which traverses the clay belt.

Face-Brick

The discussion so far has had reference to common brick made by either the soft-mud, or dry-pressed process. So much poor dry-pressed brick has been made in Eastern Canada in late years that I offer no apology for placing such in the common class. They can be bought at common prices also.

Some of the makers do keep up a high standard of excellence as regards density, finish and color for their dry-pressed product, and these always find a ready sale at prices considerably above that of the ordinary building brick.

The best architects, however, no longer regard the dry-pressed process as the high-water-mark in brick production. The smooth surfaces and tiresome uniformity of color do not lend themselves to effective treatment, especially for residence work. But it is probable that their use will be continued for business buildings.

Roughness in texture and variety of color are now regarded as most desirable qualities for face brick. The roughness is produced by a simple device attached to the brick machine, and variety of color is obtained by "flashing" during the burning process. In some localities in the United States kilns of this kind of brick are turned out which rival Turkish rugs in color and texture.

These brick are made from shales, the cost of production being practically the same as that of the ordinary wire-cut, but the profits are much greater.

A few of the leading brick plants in Ontario and Quebec have taken up the manufacture of rough-faced brick in a half-hearted manner as a recognition to a passing fad. These firms are essentially dry-pressed face brick makers; but it is significant to note that by overburning and flashing their dry-process wares they are catering to the desire for roughness of finish and diversity of color.

Of the twenty plants using either the Queenston or Lorraine shales in the triangular area included between Toronto, Hamilton and Credit Forks, twelve are wholly dry-press makers, while eight are wire-cut or mixed plants. Three of the latter make a small quantity of rough-texture face brick. One of these, the Ontario Government plant at Mimico, produces an article equally as good as most of the imported material. There appears to be an opportunity here for an enterprising brickmaker to produce a distinctive article which will bring him out of the common class into the region of greater profit.

One of the plants at Laprairie, near Montreal, uses the Lorraine shale to good effect in producing a rough-texture face brick for the Montreal market.

The Lorraine and Levis shales near the city of Quebec can be used to produce richer effects than those of the western shales.

The carboniferous shales in New Brunswick and Nova Scotia contain endless possibilities for this class of ware. That they have been unused up to the present denotes a singular lack of appreciation for the beauty of burned clay ware, and an unrivalled building material, in the cities of these provinces.

Fireproofing

Hollow blocks of various shapes, made of burned clay, are used largely as the fireproof clothing for steel frames in modern high structures—hence the trade name of fireproofing for this class of ware. The use of hollow blocks, however, is not confined to covering steel structures; they are now used extensively as a building material for the construction of exterior walls and partitions in factories, silos, dwellings and storehouses.

There are only four factories manufacturing this class of ware in Eastern Canada, and only one of these is devoted solely to this product. Three of these use surface clay, and one located in Toronto uses Lorraine shale.

The surface clay is not a very satisfactory material for fireproofing, the shales being better, as they produce a harder, stronger ware, which also stands transportation without undue loss from breakage.

The supply of home-made fireproofing is inadequate in quality and quantity.

Several brick plants already located on shales in any of the provinces might profitably take up this branch of the industry. Almost any of the plastic shales between Lake Huron and the Atlantic are suitable for the purpose. The use of hollow blocks made from burned clay is always increasing, and will continue to do so as long as building activity keeps up.

Paving Brick

Vitrifying clays or shales suitable for the manufacture of this class of clay products are comparatively rare in Eastern Canada. Nearly all of the paving brick used in Toronto and other localities in South-Western Ontario are imported from the United States. A small quantity of paving brick is made from the Lorraine shale at West Toronto. While these may be suitable for sidewalks or residential streets, their life is too short under the ordinary city traffic.

Certain shale deposits of the Levis and Sillery formations, which are probably suitable for the manufacture of paving brick, were discovered by the writer about two years ago. The Citadel Brick Company of Quebec is experimenting with these shales at present, so that paving brick may become one of its principal products in the future.

It is quite possible that paving blocks might be made from the Lorraine shales near Toronto or Montreal if a certain percentage of imported fire clay were added, in order to prolong the vitrification range of the shale and toughen the product. This is another opportunity for brickmakers in Ontario to get out of the common brick class.

The carboniferous formation in the coal mining districts of New Brunswick and Nova Scotia contain shale suitable for the manufacture of vitrified wares. No attempt has yet been made to develop this industry, the principal reason being that a market does not exist for them at that end of the country.

Sewer Pipe

Three plants are employed all the year round in the manufacturer of sewer pipe in Ontario. The raw material used is either the soft weathered top of the Queenston (Medina) shale or a transported clay washed from the same material, which occurs at Waterdown and vicinity, near Hamilton. This clay burns to a good strong red body, but does not take a very good salt glaze. It is the only material we know of in the province which is suitable for the purpose. These pipe are used extensively in Southern Ontario, notwithstanding the competition of the brightly glazed pipe made from fire clay or semi-redustrial wastes is rapidly gaining in importance, both fractory clay in Ohio or Missouri. The most extensive sewer pipe plant in the Dominion is situated at St. John, in the province of Quebec. The local clay is used, but a liberal stiffening of fire clay imported from New Jersey is added to it.

The shales already indicated as occurring in the vicinity of Levis might be used to advantage for this class of ware, as they take a good salt glaze, and are by far the most refractory shales found in the two provinces. With water transportation on the St. Lawrence and rail connection with all the principal centres, an important industry in vitrified wares might be established at Levis.

The carboniferous shales of the Maritime Provinces furnish the necessary raw materials for the manufacture of sewer pipe, as well as the coal for burning them. One plant has been established for several years at New Glasgow in Nova Scotia, which is now in a flourishing condition.

There is room for another sewer pipe plant at Moncton or in the Grand Lake coal area of New Brunswick. Ware like this is not like common brick, inasmuch as it can stand the freight charges for long haulage by rail.

Electrical Conduits

These are used for laying wires underground, their requisites being strength, straightness and impermeability. Conduits are generally made from fire clays or some semi-refractory clays or shales, finished with a salt glaze. None are produced in Canada, but hundreds of thousands of dollars' worth are imported annually from the United States. The telephone and telegraph companies prefer to go to the additional expense of conduits because of the saving in cost of maintenance and the superior service they give.

The Maritime Provinces are the only place where raw materials for this purpose are available. There is now a sufficient market in Canada to keep a large plant running on conduits alone, or it might be combined with the manufacture of sewer pipe and silo blocks.

Architectural Terra-Cotta

None of this material is produced in Canada, but it is now used extensively in all of our cities. It is generally made with a fire-clay or a buff burning semi-refractory clay, the finished ware being coated with a glaze or enamel, either white or tinted in color, or mottled to imitate granite. An industry of this kind requires a large staff of skilled workmen, for whom employment must be found all the year round.

Now that the Canadian market for architectural terra-cotta is large, a plant situated, for instance, on the Welland Canal, where fire-clay and coal could be brought by barge, ought to succeed.

The manufacture of enamelled brick and decorative tile for indoor work could be combined with the terra-cotta, as the same body and enamels could be used for all. The manufacture of red and buff terra-cotta, without a glaze, was carried on at the Don Valley Works in Toronto some years ago, but it was discontinued.

This industry might be revived again to advantage. Cornice, string courses and panels of this material could be combined with brickwork and be made very effective in many classes of buildings.

The Lorraine shales, the weathered top of the Queenston shales and certain of the surface clays can be used for this purpose.

Roofing Tile

The manufacture of roofing tile is not carried on in any part of Canada on a commercial scale. A few clayworkers in Eastern Canada have made tile for roofing houses in the vicinity of their plants, but none of them care to undertake making them for sale. The manufacture of roofing tile at the Ontario Government plant at Mimico has passed the experimental stage. They are now producing red tiles from the Lorraine shale which is as good in color and body as any of the imported tile. These tile are for the new Asylum Buildings at Whitby and are of the Spanish or "S" type. A large quantity of roofing tile is imported annually into this country for use on the best class of buildings. The shales in Ontario or the Maritime Provinces will supply the raw material, but a considerable amount of skill is required to make them.

Fuel

Fuel is one of the most important items to be considered in the future of the clayworking industry in Canada. Not so many years ago, wood was the only fuel used for burning. It was plentiful and cheap, and no very high temperatures were required for the class of clay wares then being made. Wood is increasing in price, and harder to obtain in large quantities. Higher temperatures with longer sustained fires are required for the better class of clay wares, and more coal than wood is now used in the clayworking industry in this country.

No coal occurs in either Ontario or Quebec, and very little in New Brunswick. Nova Scotia coal is shipped as far as Montreal. Very little of it comes further west. Most of the coal used in Ontario comes from Pennsylvania.

There is great waste of coal in the clay industry, due to defective or poorly built kilns, badly constructed furnaces giving imperfect combustion, careless firing and other causes. The use of producer gas or a perfect combustion furnace are two methods proposed by the brickworks' engineer for the elimination of waste in fuel.

A discussion of the various devices in kilns and furnaces is beyond the scope of this paper, but it has been demonstrated beyond question in a few plants that an immense saving of fuel can be effected and the smoke nuisance almost eliminated.

Refractory Goods

Clays suitable for the manufacture of refractory or even semi-refractory wares, practically do not occur in the provinces of Ontario and Quebec, as far as we know at present.

Fire clay is known to exist at one point in Ontario, but it is situated too far from transportation to be of economic value. This occurrence is situated on the Missinabi River, about forty miles north of Cochrane, a point on the National Transcontinental Railway. The deposit consists of white, pink and yellow plastic clays, the white clay, only, being a fire clay. Borings made on the deposit show at least 25 feet in thickness over a considerable area, 15 feet of which is white clay.

A four-foot bed of semi-refractory clay, softening at a temperature of about 1,600 deg. C., is found underlying the coal seam in eastern portions of the Grand Lake coal area of New Brunswick.

Plastic fire clays occur at three localities in Nova Scotia—at Shubenacadie, Inverness and Middle Musquodoboit. There is no railroad connection near the latter deposit. A large body of plastic felsite, which in this instance is a refractory rock but not plastic, occurs at Coxheath near Sydney. When this material is crushed and mixed with enough plastic fire clay to make it workable, an excellent quality of fire brick can be produced. No fire brick is made from the native refractory clays in the Maritime Provinces, one of the principal reasons for this being that the Scotch fire brick can be delivered from steamships at a very reasonable rate.

Stove linings and special shapes of fire-clay goods are made at St. John and Montreal in the province of Quebec. The fire clays for this purpose are imported from the State of New Jersey.

Silica brick are made from crushed quartzite, to which is added about three per cent. of lime for bonding purposes. These brick are molded by hand, and burned in kilns at a very high temperature. The raw material for this class of refractory ware occurs in Canada, but the cost of fuel for burning is large.

Whiteware

This term is used here to include table-ware, sanitary and electrical porcelain, white floor and wall tile. The raw materials entering into the composition of all whiteware bodies are: (1) kaolin, which is generally known by the trade name of China clay; (2) ball clay; (3) feldspar; (4) flint.

A limited amount of China clay is produced in Quebec, at a point about forty miles North-West of Montreal. This is the only locality, so far as known, at which it occurs. No ball clay has so far been found in Canada. Canadian feldspar is mined north of Kingston, Ontario, and shipped to New York State for grinding. Flint is generally ground quartz in America. Most of it is produced in the State of Maine, where it is ground for use in potteries. A large amount of fire clay is also used in the pottery industry, for making saggers—which are practically fire-clay boxes for holding the ware while burning. Whiteware industries are often situated at points where none of the raw materials occur, except possibly the fire clay. Convenience of transportation, a cheap fuel, and a large supply of skilled labor are the essential features of a pottery centre.

No table ware is made in Canada. There are two plants at St. John, Quebec, which manufacture sanitary porcelain.

Electrical porcelain is now made in Hamilton, Ont., by the Canadian Porcelain Company. Their output is chiefly large insulators for power lines. The General Electric Company also manufacture a certain amount of their porcelain at Peterborough. A plant for the manufacture of white vitrified floor tile was built recently at Kingston.

Every particle of the raw material used in the above industries is imported from England and the United States. As the consumption increases these factories will be enlarged or probably other factories will be established at various points in the future.

Economic considerations are probably against the establishment of an industry for the manufacture of table ware in Canada. These articles will continue to be imported for a considerable time to come. The only difference will be that a larger proportion will come from England, France and the United States, which hitherto came from Germany and Austria.

The time is past when anything that looked like a brick could be sold at a profit. The future demands will be more exacting, so that those clayworking plants which do not strive after excellence in production or are located on poor material will have to drop out of the business.

The weak spot in the clayworking industry is the lack of technical knowledge on the part of the majority concerned in it. Many costly mistakes are made every year in various parts of the country, being due to poor location, wrong equipment, or defective raw material.

Considerable skill and experience are required to build a modern clayworking plant and start it into successful operation, but the tendency seems to be to use the cheapest advice, on the popular assumption that anyone can make brick or tile.

Clays contain more disagreeable surprises for unwary manufacturers than any other kind of raw material, and it is often possible to detect and provide against these troubles in the preliminary examination.

The raw materials used in whiteware industries are fixed, and to a certain extent, unvarying. It is possible to foretell very closely what kind of ware will be produced in practice.

The things to be considered in starting an industry of this kind are: (1) a market for the wares; (2) location of plant; (3) fuel supply; (4) conditions favorable to a permanent supply of skilled labor. These questions, of course, are dependent on the vital one—whether foreign competition can be met. In the manufacture of clay products for structural materials, where the raw material is of an infinite variety, no reasonable trouble or expense should be spared during the preliminary investigations of the proposed site.

The following figures, compiled by Mr. John McLeish, of the Bureau of Mineral Resources and Statistics of the Department of Mines, show a considerable annual increase in the output of clay products during the last three years:

Value of Production of Clay Products by Provinces

	1911	1912	1913
Nova Scotia	$ 274,249	$ 272,053	$ 332,272
New Brunswick	38,000	54,910	62,269
Quebec	1,341,467	1,680,460	1,606,816
Ontario	3,916,575	4,864,700	5,220,467
Total value for Eastern Canada	$5,570,291	$6,872,123	$7,221,824

Extent of Production and Consumption of Clay Products in the Dominion

Total value of clay products produced in Canada during 1913	$9,504,314
Total value of clay products imported into Canada during 1913	7,237,885

Owing to the depression in the building trade during the latter part of 1914, it is probable that some decrease will be shown in the production of rough clay products when the returns are compiled. The clay industry, however, does not suffer to the extent that many others do in time of general depression.—Brick and Clay Record.

In New York City it is proposed to erect a building to be known as the Pan-American Building. If the plans go through, the new structure will put all other sky-scrapers in the shade, as they call for a building over one thousand feet high. The cost is estimated at seventeen million dollars.

Specifications for Bituminous Road Binder

THE following specifications followed carefully, according to Municipal Engineering, Indianapolis, will ensure an excellent material for bituminous road construction:—

A bituminous road binder, in order to be eligible for use under these specifications for the construction of a bituminous surface, of the type herein called for, must comply in all respects with the following practical and established tests for the purpose hereinafter stated.

The bid of each contractor must specifically state the brand of bituminous road binder which he proposes to use. He must give the name, nature, and chemical analysis of the material to be used, and where and by whom produced. His bid must be accompanied with a sample of at least 1 lb. of it, properly marked and identified. Bids which do not comply with this requirement will be rejected as irregular.

Test 1: Ductility.—In order to demonstrate the cementitious or adhesive character of the bituminous road binder, such binder as used must have a ductility of not less than 50 cm. at 77 deg. Fah., according to the District of Columbia standard.

Test 2: Specific Gravity.—In order to demonstrate that the bituminous road binder is of an asphaltic and cementitious character, as distinguished from an oily and non-cementitious character, and to preserve the proper balance between its adhesive and cohesive qualities, the specific gravity shall be not less than 1.04 at 77 deg. Fah.

Test 3: Paraffin Scale.—In order to further demonstrate that the bituminous road binder is of an asphaltic and cementitious character, and to ensure against the excessive use of non-cementitious materials produced from oils having a paraffin base, the bituminous road binder must not contain more than one-half of 1 per cent. of paraffin scale, as determined by the Holde method.

Test 4: Penetration.—In order to demonstrate that the bituminous road binder proposed to be used is of the proper degree of consistency, it must, when tested for five seconds at 77 deg. Fah. with a No. 2 needle weighted with 100 grammes, have a penetration of at least 12 mm. and not more than 15 mm.

Test 5: Volatilization.—In order to demonstrate that the bituminous road binder is of a sufficient stability to ensure against loss of consistency and cementitiousness upon being subjected to working heat, it shall meet the following test:—When 50 grammes of the bituminous road binder are heated in a dish 2¼ in. in diameter for seven hours at 325 deg. Fah., the loss shall not exceed 3 per cent. and the penetration and ductility of the residue shall not be reduced more than 50 per cent. from its original consistency and ductility.

Test 6: Viscosity.—In order to demonstrate that the bituminous road binder is of the proper degree of viscosity and to demonstrate that such binder has a sufficiently low melting point to ensure its penetration to a sufficient depth when poured upon or over the cold stone (or to ensure its mixing properly and conveniently with the mineral aggregate), it shall have a float test of not more than five minutes at 150 deg. Fah., as determined by the float test apparatus manufactured by Howard and Morse, Brooklyn, N.Y.

Test 7: Purity of the Bituminous Road Binder.—In order to demonstrate the percentage of bitumen in the bituminous road binder, and in order to regulate the uniformity of this material, it shall be soluble to the extent of at least 95 per cent. in carbon disulphide.

Test 8: Flash Point.—In order to ensure safety of operation the bituminous road binder must show a flash point (New York State closed oil tester) of not less than 325 deg. Fah.

Test 9: Durability.—In order to demonstrate that the bituminous road binder is sufficiently stable and durable, it must not suffer a reduction in ductility of more than 10 per cent. from its original ductility after it has been incorporated in the paving mixture and extracted therefrom with purified carbon disulphide.

Test 10: Standard.—Any bituminous road binder to be eligible for use under these specifications must be in all respects equal in quality to the standard bituminous road binder produced from refined Bermudez Lake asphalt; but whether the binder used is produced from refined Bermudez Lake asphalt or otherwise, it shall not be considered as complying with these specifications unless it complies with each and all of the tests hereinabove specified.

By having the plans for the enlargement of the Montreal filtration plant drawn in Montreal, instead of in New York, the city will save $6,000 in duties. The data will be supplied by Messrs. Hering & Fuller, the New York engineers.

Now that Germany, France and Belgium are in all likelihood to remain in the background for some years as far as furnishing railway material is concerned, large orders are likely to be placed in Canada, as the worn-out stock on the Argentine railways will have to be replaced if the railways are to be maintained in a state of efficiency. The Argentine railways extend to 21,000 miles.

Personal Mention

J. A. Culverwell, a well-known hydraulic and electrical engineer, died recently in Toronto.

Mr. J. G. Cummings has been confirmed in his appointment of City Engineer of Cranbrook, B.C.

Messrs. Huot, Henderson & Wadsworth, architects, have removed from the New Birks Building to 427 Old Birks Building, Montreal.

Mr. V. W. Horwood, Provincial Architect, of Manitoba, left Winnipeg last week for Rochester, Minn., where he will undergo an operation.

Mr. J. E. Parker, Town Engineer, of Amherst, has taken up the reins of office again after rather a serious indisposition of two or three weeks.

Capt. G. E. Blake Begy, a well-known contractor of St. Catharines, Ont., is among the wounded reported in the recent casualty list from the front.

Mr. DeGaspe Beaubien, consulting engineer and a member of the Montreal Electrical Service Commission, has been elected Vice-President of the Canadian Club, Montreal.

Mr. C. W. Van Buren has been appointed General Master Car Builder by Mr. C. W. Woodhouse, Chief Mechanical Engineer of the C. P. R., in place of Mr. R. W. Burnett, who has resigned.

Mr. George Janin, Chief Municipal Engineer and City Surveyor of Montreal, who was largely instrumental in raising a new corps of engineers for service in Europe, has left for England on his way to the front.

Mr. William Murdoch, City Engineer, of St. John, has returned to New Brunswick after an extended tour of western Canada, in the course of which he visited Toronto, Winnipeg, Calgary, Edmonton, and other cities.

Lieut. F. H. Hertzberg, Toronto, of the Second Field Company of Canadian Engineers, was among the wounded reported in the last casualty list. The company to which he belongs is commanded by Captain T. C. Irving, Jr.

Lieut.-Col. W. P. Anderson, C.M.G., Chief Engineer of the Department of Marine and Fisheries, Ottawa, has gone to British Columbia for a six weeks' inspection trip. He is accompanied by the Deputy Minister of his Department.

Lieut. Herbert N. Klotz, who was killed in the recent battle north of Ypres, hailed from Toronto, where he was formerly employed as chemist by the Gutta-Percha and Rubber Company. Mr. Klotz was a graduate of the School of Practical Science.

Major Edward C. Norsworthy, of the 13th Battalion, Montreal, who was killed during the fighting at Langemarck, was a director of the Canada Cement Company, while Major Robt. Harry Jamieson, who was wounded in the forearm during the same battle, is Vice-President of R. C. Jamieson & Company, paint, varnish, and dry color manufacturers, Montreal.

Mr. J. A. Shaw, who has been Electrical Engineer of the Eastern Lines of the C. P. R. since 1908, with offices in Montreal, has been appointed Electrical Engineer of the entire C. P. R. system. Mr. Shaw joined the C. P. R. in 1904 as Assistant Electrical Engineer of Motive Power at the Angus Shops. He was made Electrical Engineer of the Eastern Lines four year later.

Mr. Ralph Hewson, of the engineering staff of the Toronto Harbour Commission, has joined the C. P. R. Overseas Construction Corps, and has left for St. John, N.B. Before his departure he was presented with a wrist-watch, a fountain pen, and an army jack-knife by members of the Commission staff. He is a brother of Mr. E. G. Hewson, Resident Engineer of the G. T. R. at the Union Station, Toronto.

Mr. W. A. McLean, Chief Engineer of Highways for the Province of Ontario, has returned to his office in the Parliament Buildings, Toronto. This will be welcome news to a wide circle of his friends. Mr. McLean was seriously indisposed in his home for several weeks, and it was particularly unfortunate that he was unable to discharge his duties as President of the International Road Congress held recently in Toronto.

Mr. Frank S. Swales, architect for the Hotel Vancouver, and other important structures, has just returned to Vancouver from San Francisco, where he went to superintend the finishing touches on the C. P. R. building at the Panama-Pacific Exposition, which he designed. He says that the extent and nature of the Japanese exhibits at Jewel City indicate that the aggressive Orientals intend to make a strong bid for the trade formerly almost exclusively handled by Germany.

Mr. William I. Bishop has been nominated for the office of Second Vice-President of The American Society of Engineering Contractors. Mr. Bishop has had a broad experience in engineering construction, both as a civil engineer and as a contractor. A record of his past work includes water-power developments, railroad construction, subways, tunnels, sewers, deep foundations, factory and other buildings. At the present time Mr. Bishop is a member of the Quebec Streams Commission, which has under its charge the improvement of the rivers of the Province of Quebec.

Mr. Samuel Hill, President of the Pacific Highway Association, accompanied by Major Bowlby, formerly State Highway Engineer of Oregon, has been making a tour of the good roads of Vancouver Island. Interviewed at Victoria, B.C., he said that he hoped that 1915 would witness the completion of the road from Vancouver, B.C., to the Mexican border. The most important addition, which would be opened this summer, was the Columbia River highway, upon which section some of the best road work on the Pacific Coast had been carried out. Mr. Hall had something to say about the importance of good roads. Railways followed later, he said; and he expressed the opinion that British Columbia, Washington and Oregon would be peopled very thickly in a few years, owing to the fact that every form of vegetation was possible on the Pacific slope.

Mr. Joseph Race on the Chlorination of Water

Mr. Joseph Race, City Bacteriologist of Ottawa, gave an address on the chlorination of water before a recent meeting of the Society of Chemical Industry in Montreal. Mr. Race gave it as his opinion that a properly applied treatment with calcium hypochloride of such water as that of the Ottawa River was the most practical method of attaining a pure supply. He dealt with many phases of the question, asserting that efficient admixture of the compound was the secret of successful treatment of the water, since better results were obtained by this method with a smaller quantity of the chemical than by using more hypochloride without recourse to mechanical means of diffusing it. He gave figures as a result of tests made in Ottawa, showing that, without mechanical admixture, a purification of only 87.5 per cent. had been obtained, while the water was made 99.2 per cent. pure by means of the process now employed.

With regard to corrosion of hot water systems, the speaker believed that no appreciable difference was made by this treatment of the water, as such soft waters as that of the Ottawa River were naturally prone to injure heating plants. If more frequent complaints had been made of such corrosion since the chlorination system had been in use, Mr. Race believed this was due largely to the inferior quality of the galvanized pipes put on the market, for he had found that many samples of such galvanized pipes, though well coated with zinc on the outside, were deficient in the inside. Brass or copper pipes might be more economical in the long run.

Tests had proved that the chlorination of water, as now practised in Ottawa, had no injurious effect on vegetable life, though animals refused to drink the water in normal quantities when a certain amount of the chemical diffused in it was passed. Such excess, however, was not required.

Messrs. W. F. Stanley & Company, Limited, 286 High Holborn, London, England, have sent us particulars of a new form of trench periscope which should make a most acceptable present for any soldier at the front. The "Stanley" periscope is a thoroughly practical instrument, with a strong collapsible aluminium frame, with two spikes for fixing into the side of the trench. It is equipped with plate-glass mirrors, well protected by metal sheaths. The whole is contained in a strong waterproof canvas case. The price is $6.50. The close proximity of the opposing trenches makes it of vital importance that the men should be enabled to take observations without exposing themselves, and this can only be done effectively by the use of such an instrument.

Messrs. A. H. Winter Joyner, Limited, representatives of a number of leading electrical specialty companies, have removed their offices from 76 Bay Street to 100 Wellington Street West, Toronto.

Mainly Constructional

East and West From Coast to Coast

The Brown Hoisting Machinery Company has been registered at Montreal.

Messrs. T. Benard & Sons, general contractors, Montreal, have dissolved partnership.

The Government of New Brunswick has adopted legislation granting a bonus for the erection of wheat mills throughout the province.

The Georgia-Harris bridge at Vancouver has been completed, and it is expected that the structure will be open to traffic on May 24.

The Frid-Lewis Company, Limited, contractors, of Winnipeg, are reported by Bradstreets to be in liquidation, with Mr. C. H. Newton interim liquidator.

The Kirkfield Portland Cement Company, Limited, Toronto and Raven Lake, are reported by Bradstreets to be in liquidation, with Mr. G. T. Clarkson appointed Receiver.

The Alberta Legislature have passed a bill providing for a Government loan of two million dollars to the Central Canada Railway for the construction of the McLellan-Peace River Crossing line.

At Calgary, Alta., the Council are strongly in favor of proceeding with the erection of the Centre Street bridge this year, and they are making every effort to sell the bonds for the bridge, which total some $375,000.

At North Temiskaming, Que., the substructure for a large steel bridge, costing $100,000, is nearing completion. The structure is being erected by the Dominion Government, whose engineer on the work is Mr. M. V. Denis.

New Brunswick is expecting to have a large influx of United States tourists this summer, and as a result the building of hotels is receiving an impetus. It is of interest to learn that plans are being prepared for the erection of a large hotel at St. John, N.B.

The offices and factory of the Ideal Concrete Machinery Company, Limited, have been removed from London to Windsor, Ont. The new plant is built entirely of concrete blocks made from the company's machinery, and demonstrates the practical use of this material for factory construction.

It is interesting to hear that Messrs. Masson, Limited, dealers in contractors' supplies, Quebec City, are doing quite a good business. Their structural steel department is in the hands of Mr. E. D. Kellogg, M.E. Their latest contract, which is worth $25,000, is for the structural steel frame of the new St. Roche's Church, Quebec.

The fair-wage scale proposed by the Montreal civic controllers, to which the Builders' Exchange objected as being in some instances beyond the rates asked for by the trades unions, has been rejected by the City Council. The objection was that the scale was not equitable, and that it was higher than that agreed upon between the contractors and the trades unions.

The plans for Calgary's new armoury have been completed by Mr. Leo Dowler—and it may be mentioned that tenders are open until May 25. The building is to be of red brick, with stone trimmings. The main drill hall will be 100 feet wide and 200 feet long. The armoury is the first of an extensive Government programme, which includes the new Post Office, Federal Building, and Receiver General's Building.

At a banquet held last week by the newly-organized Builders' Exchange, Guelph, Ont., a provisional committee was organized, with Mr. J. Occomore as Chairman, Mr. W. P. Colwill, Secretary, and the following members: Messrs. G. E. B. Grinyer, W. Cowan, R. Williams, A. Reynolds, J. J. Mahoney, C. Butler, W. G. Howell, H. Occomore, W. W. P. Colwill, and J. Baetz. A number of interesting addresses were given during the course of the evening. Mr. George Gonder, of Toronto, Vice-President and Secretary of the Provincial Association, was one of the speakers.

The Federal Government has placed an order for 2,500,000 barrels of cement with the Canada Cement Company, this being the second largest order for cement placed on the continent. The largest order—that for the Panama Canal—totalled four million barrels, and this went to a United States company. The delivery of the cement under the contract awarded the Canada Cement Company is spread over four years, the material being required chiefly for the Welland Canal. Although the construction of the canal is being carried out by contractors, the cement is supplied by the Government.

The Shawinigan Electro-Metals Company, Limited, has been incorporated with a capital of $50,000. Shawinigan Water and Power interests are identified with the company, Mr. Howard Murray, Mr. W. A. Hart, and Mr. Julian C. Smith being incorporators. Dr. A. Stansfield, of McGill University, is also an incorporator. The purpose of the company for the present is to carry out further experiments at Shawinigan Falls for the reduction of metals by electricity. Dr. Stansfield has done a large amount of work already in this direction at McGill University. He is at present on a visit to Vancouver, B.C.

Although a great majority of the Montreal building permits are for small residences or alterations, there are a few important buildings either in course of erection or contemplated. The contracts for the civic library and the St. Denis Theatre have been let, and tenders were called recently for the Oratory of St. Joseph of Mount Royal, and for a college for the Christian Brothers, Laval des Rapides, P.Q. The latter is a large project, the estimated cost exceeding half a million dollars. Some buildings for which plans were drawn last year, and in certain instances contracts concluded, are still held up.

At Victoria, B.C., judgment has been given in the action brought against the city by the Westholme Lumber Company to recover $500,000 in connection with a contract for the construction of the Sooke Lake waterworks system. The decision is in favor of the city, and establishes the fact that the contractors, having other important works on their hands at the time, had not the finances or equipment to carry out the Sooke Lake contract efficiently. The judgment is given by Mr. Justice Murphy, whose findings, according to the local press, are contained in a volume of sixty-four pages, comprising some sixteen thousand words. The hearing lasted six weeks.

Immediate action by the Joint Commission that has been investigating the pollution of boundary waters is promised by Dr. J. W. S. McCullough (Provincial Officer of Health), who returned to Toronto last week from Buffalo, where he had been in consultation with the Commission's Engineer. Dr. McCullough intimates that Buffalo and Detroit will probably be the first two cities to benefit. It is expected that they will be advised by the Commission to proceed with the preparation of plans for sewage treatment that will put a stop to the dumping of polluted matter into the lakes and rivers. The intention is to have the necessary arrangements proceeded with in order to get a start upon construction by next spring. While in Buffalo, Dr. McCullough, having in mind Toronto's steps toward garbage incineration, visited the Buffalo incinerator plant. The Provincial Officer of Health strongly criticizes the method adopted of employing women to sort the garbage as it passes along the carriers to the incinerator.

Interesting and Thrilling Work on the Fraser River

Mr. J. P. Napier and Mr. J. McHugh gave interesting papers—illustrated by lantern views—at a recent meeting of the Vancouver Branch of the Canadian Society of Civil Engineers, presided over by Mr. G. R. G. Conway. The speakers told of the remedial works on the Fraser River carried out by the Dominion and Provincial Governments in order to protect and foster the salmon fishing industry of the province, which for a time was seriously threatened by the partial blockade of the canyon through railway construction operations. Mr. Napier, Assistant Engineer of the Provincial Public Works Department, dealt with the preliminary work which had been done by the province in 1913, and Mr. McHugh, Engineer to the Dominion Fisheries Department, discussed in detail the main scheme undertaken later by the Federal authorities. In describing the main scheme Mr. McHugh explained that the work was carried out in the face of the most adverse physical disadvantages. The place where the big slide occurred was near the narrowest part of the Fraser River Canyon, Hell's Gate, where water foams through a restricted passage with terrific velocity. The sides of the chasm are precipitous cliffs, naked walls of rock, affording no foothold for the workmen. How the operations were conducted formed an interesting story of scientific method, painstaking endeavor and courageous effort on the part of engineers and workers alike.

Indians from far and near gathered near Hell's Gate in anticipation of a rich harvest. From time immemorial the aborigines had looked upon the narrow portions of the canyon as a provision by a beneficent Providence for their welfare and subsistence. They made preparations for a wholesale slaughter of the millions of salmon trapped on their way to the spawning grounds.

The Fisheries Department, however, took a different view of the situation. Stringent regulations were passed and enforced to prevent the threatened big killing. While the tremendous masses of rock were being blasted away temporary steps to alleviate the congestion were taken. Thousands of fish were caught in nets and transferred up the cliffs in baskets and across the most turbulent section of the torrent, and released again.

A flume was then built to divert the salmon to the upper reaches. The building of this facility entailed great physical discomfort to the workmen, who had to be suspended by ropes over the sides of the precipitous chasm, and there—drenched by icy spray, and often beneath the swirling waters—pursue their activities.

The work, which was started on March 21, 1914, was completed on March 9, this year. In all 60,000 cubic yards of rock were taken out, 40,000 being removed from Hell's Gate. The operations cost $110,000.

Peculiar Legal Case Now in Progress at Vancouver

Details of a peculiar case are to hand from Vancouver, B.C., where the Frantz Construction Company and A. Clemes are suing each other for $40,000.

Mr. Clemes is the proprietor of the Regent Hotel, which was built for him by the Frantz Construction Company. For some time prior to June, 1914, Mr. Clemes had been away in South America, leaving his business affairs in the hands of Mr. James Young. It is claimed by the plaintiff that in January, 1914, Mr. Young, acting on behalf of Mr. Clemes, entered into a contract to erect another eight-storey hotel, similar to the Regent Hotel, on a piece of property owned by Mr. Clemes on Hastings Street. Several stores were on the property.

An elaborate agreement was drawn up providing for a payment of $121,000 for the work, of which $100,000 was to be raised by a mortgage at 8 per cent. Mr. Frantz was to endeavor to get a tenant for the hotel at a rent of $1,600 per month for the first year, $1,700 per month for the second and third years, $2,000 per month for the fourth, fifth, sixth and seventh years, $2,300 a year for the eighth and ninth years, and $2,400 a year for the tenth year.

Mr. Frantz said he secured a prospective tenant and started at work on the contract by ordering the tenants to leave the old stores, which he proceeded to tear down. While the wrecking was in progress Mr. Clemes returned from South America and repudiated the whole contract, ordering the work of destruction to cease. Claiming that Mr. Young had power to act as agent for Mr. Clemes, the Frantz Construction Company is claiming $41,354 damages for breach of the agreement.

In his defence Mr. Clemes denies that Mr. Young had any authority to enter into such a contract on his behalf. He says it cost him $27,400 to repair the damage done by the wreckers to his property, that he had to pay $4,000 compensation and that he lost $9,425 in rents. Accordingly he counterclaims for $39,645 damages.

Trade Inquiries

The Weekly Report of the Department of Trade and Commerce contains the following inquiries relating to Canadian trade. The names and addresses of the firms making these inquiries can be obtained by those specially interested in the respective commodities upon application to the Inquiries Branch, Department of Trade and Commerce, Ottawa:—

551. **Steel, iron, nails, wire.**—A firm in Paris is desirous of receiving offers from Canadian mills.

559. **Steel, iron bars, flats, square, round, etc.**—A French firm of dealers in metals is anxious to receive offers from Canadian mills.

543. **Sewer pipes.**—Canadian manufacturers of earthenware sewer pipes should communicate at once with a Newfoundland official.

527. **Building timber.**—An Australian firm seeks supplies of British Columbia fir, hemlock and other building timber

528. **Fibro-cement sheets.**—Inquiry is made by the London office of an Australian firm for names of Canadian manufacturers of fibro-cement sheets.

519. **Lumber for building purposes.**—Two French firms are anxious to receive quotations, etc., from Canadian mills and exporters.

Frank Law, a contractor who has carried out a considerable number of road improvement contracts throughout Ontario, was instantly killed on the Kingston Road, Toronto, last week, when his car ran into a ditch and turned turtle. The late Mr. Law was forty-five years old.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Acton, Ont.
The Town Council contemplate laying a Tarvia pavement on Mill Street this summer. Clerk, A. J. McKinnon.

Belleville, Ont.
The City Council will shortly call for tenders on the construction of two main sewers in the west end. Clerk, J. W. Holmes.

The City Council propose to lay watermains on parts of Earle Street. Engineer, J. W. Evans.

Berlin, Ont.
The Provincial Board of Health have ordered the construction of eight filter beds here this summer. City Clerk, A. H. Miller.

Bertie Township, Ont.
The Township Clerk, M. S. Pound, Ridgeway, will receive tenders between May 22nd and 31st for laying 300 feet of 6-inch concrete drain and for 16,500 yards of excavation. Engineer, L. A. Kinnear, Port Colborne, Ont.

Brockville, Ont.
Tenders for the construction of a mechanical filtration plant will be received until 5 p.m., May 17th, by the Chairman of the Public Utilities Commission, C. R. Deacon. Plans and specifications at office of Town Engineer, G. W. Bryson.

The City Council contemplate laying watermains on several streets. Clerk, Geo. K. Dewey.

Chatham, Ont.
A by-law has been passed providing for the construction of granolithic sidewalks on West and Poplar Streets. Engineer, F. P. Adams.

Cranbrook, B.C.
Town Engineer McCullough has been instructed to purchase 1,750 feet of 4-inch steel water pipe and four fire hydrants.

Eastview, Ont.
The Town Council will receive tenders for the construction of 628 feet of sidewalk, 4 feet wide, on Ogilvery Street. Engineers, Patterson & Byrne, 71½ Sparks Street, Ottawa.

Granby, Que.
A by-law has been passed to authorize the Town Council to borrow $128,279 from the Government for road work. Secretary, P. A. Peltier.

Hamilton, Ont.
The City Council are considering the construction of a sewage system in Hamilton Park and McA'Nulty Surveys. Clerk, S. H. Kent.

The City Council propose to lay 6-inch watermains on various streets. Engineer, A. F. Macullam.

Hull, Que.
The ratepayers will shortly vote on a by-law to provide for the laying of a 5-in. watermain from Reboul Street to Gilmour Lumber Company's yard. Engineer, H. Laforest.

Humberstone, Ont.
The Village Council will shortly submit a by-law to raise $7,000 for improvements to streets and county roads. Clerk, J. J. Wichman.

New Glasgow, N.S.
Estimates for the laying of a pavement on Archimedis Street will be prepared by the Town Engineer, C. S. Fraser. Material not decided on.

Peterborough, Ont.
The City Council propose to lay paving on Park Street, and have asked the City Engineer to recommend a material for this work. Concrete will not be used. If the work is carried out, the Peterborough Radial Railway Company, 287 George Street, will require paving brick, rails, ties, etc., for laying a heavier track.

Port Colborne, Ont.
The Town Council contemplate laying watermains on Fares and Mar Streets, and will receive prices on 4-in. and 6-in. steel or cast iron pipe. Clerk, D. Alair.

A by-law will be voted on shortly to raise $6,500 for improvements to streets.

St. Lambert, Que.
Tenders are invited by the City Council for the laying of concrete pavement, street asphalt and asphalt concrete pavement on concrete base. Approximate quantity, 58,000 square yards. Plans and specifications at office of Engineer, E. Drinkwater, Town Hall.

Stratford, Ont.
The City Council are about to lay cement sidewalks on Player and Romeo Streets. Engineer, A. B. Manson.

The construction of sewers on St. David's Street is contemplated. City Clerk, R. R. Lang.

Tenders will be received until 5 p.m., May 15th, by the City Engineer, A. B. Manson, for the supply of approximately 5,460 lineal feet of 48-inch reinforced concrete pipe and 6,260 feet of 36-inch pipe.

Sydney, N.S.
The City will shortly commence the construction of watermains by day labor under the supervision of the City Engineer, Norman K. Hay.

Toronto, Ont.
The Board of Control will receive tenders until May 11th for asphalt and brick block paving on Christie Street, and concrete curb on Regal Road, Northcliffe Boulevard and Springmount. Specifications at office of Works Department, City Hall.

Walkerton, Ont.
A by-law has been passed providing for extensions to watermains, estimated to cost $5,000. Work will be done at once by day labor. Engineer, James Warren.

Wentworth County, Ont.
The following road work will be undertaken this year: Caledonia Road, $15,574; Stoney Creek Road, $9,676; Green's Road, $2,135; Ninth Concession, $4,309. County Clerk, J. W. Jardine, Court House, Hamilton.

Weyburn, Sask.
The City Council are considering the laying of a 12-inch watermain from Second Avenue to the Power House, at an estimated cost of $6,000. Clerk, E. H. Phillips.

CONTRACTS AWARDED

Dunnville, Ont.
The contract for the construction of sewers on Canal Street has been let by the Town Council to Frontier Construction Company, Niagara Falls, Ont., at $3,114.

Ford City, Ont.
The Town Council have let the contract for the construction of an 8-in. cast iron watermain to Chick Contractng Company, McDougall Street, Windsor, Ont. Approximate cost, $10,000.

London, Ont.
The Board of Control have let the contract for the supply of storm sewer concrete pipe to the Webster Construction Company, London, at $28,444, and for vitrified glazed tile to the Ontario Sewer Pipe Company, Mimico, at $3,028.

Quebec, Que.
The tile pipe required for the drainage and waterworks system being constructed for the City Council is being supplied by the Standard Clay Products Company, St. Johns, Que., and the cast iron pipe by the Canadian Iron Corporation, Montreal.

The following contracts for waterworks supplies have been let by the City Council:—lead pipe and brass work, Mechanic Supply Company at $7.50 per 100 lbs.; pig lead, Chas. A. Parent, Bridge Street, at $5.75 per 100 lbs.; brick, C. A. Cantin, 51 Marie de L'Incarnation Street; castings, Terreau & Racine, St. Paul Street, at $52 and $43.80 per ton, and F. X. Drolet, Bridge Street, at $55 per ton; clay pipe, Standard Clay Products Company, St. John, Que.; cement pipe, Cement Products Company, Quebec; shovels and cement, Samson & Filion, St. Paul Street. Cement at 50c., 54c., 57c., and 63c. according to place of delivery.

Stratford, Ont.
The contract for the construction of concrete curbs and gutters has been let by the City Council to McFalaine, Morgan & Cass, Paris, Ont., at $5,752.

Railroads, Bridges and Wharves

Blandford Township, Ont.
Tenders will be received until May 10th by the Town Clerk, G. Cliver, Bright, Ont., for the construction of a bridge, consisting of a 40-foot steel girder span and concrete abutments. Plans and specifications at offices of the Clerk and the Township Engineer, F. J. Ure, Woodstock, Ont.

Haldimand County, Ont.
A Bill has been approved by the County Council for the construction of five bridges, and alterations to two others. County Clerk, H. Arrell, Cayuga, Ont.

Medicine Hat, Alta.
The City Council have instructed Engineer A. K. Grimmer to make a report on repairs to the Finlay Bridge. Flooring will be renewed. Approximate cost, $10,000.

Moncton, N.B.
Tenders will be received until May 12th by the Provincial Department of Public Works for the erection of Somers concrete arch culvert and railway embankment, and for the reconstruction of Scotch Settlement Bridge over McLean Brook. Specifications at office of MacLean Daily Reports, Limited, 119 Board of Trade Building, Montreal, Que.

Quebec, Que.
A by-law will shortly be voted on to compel the Quebec Railway, Light, Heat & Power Company, St. Joseph and Crown Streets, to extend their lines to St. Malo and Belvedere Wards.

Revelstoke, B.C.
The Lanark Mining Company are about to construct a tramway 7,000 feet long at an estimated cost of $12,000. Promotors, W. B. and L. M. Dornberg, Spokane, Wash.

South Dumfries Township, Ont.
The Township Council are having plans prepared for a bridge on the 4th Concession. Tenders will be called for as soon as the plans are approved. Clerk, H. Maus, Paris, Ont.

Toronto, Ont.
Tenders will be received until May 11th by the Board of Control for the supply of red lead paint for the Bloor Street Viaduct. Commissioner of Works, R. C. Harris.

Valleyfield, Que.
J. W. Pugsley, Secretary to the Department of Railways and Canals, Ottawa, Ont., will receive tenders until 4 p.m. on May 7th, for the construction of works for protecting Government Dam. Plans and specifications at offices of Town Engineer, Ottawa, and Superintending Engineer of Quebec Canals, Montreal, Que.

CONTRACTS AWARDED

London, Ont.
The contract for the construction of a roller coaster in Springbank Park for the Victoria Amusement Company, has been let to the Amusement Construction Company, Scranton, Pa., U.S.A. Approximate cost, $10,000.

Public Buildings, Churches and Schools

Acton, Ont.
The Town Council have been requested by the Library Board to make arrangements for further accommodation or for the erection of new building. Clerk, A. J. McKinnon.

Benson, Sask.
The Trustees of School District No. 1933 have been authorized to borrow $3,000 for the erection and equipment of a school. Treasurer, R. S. Hainstock, Benson.

Clarkson, Ont.
The School Board of School Section No. 6, Toronto Township, have decided to have plans drawn for an addition to the present building. Secretary, George Adamson.

Essex, Ont.
A meeting of the Anglican Congregation will be called shortly to discuss plans for a new church.| Pastor, Rev. H. Millar. Estimated cost, $7,000.

Fort William, Ont.
The Provincial Department of Public Works, Parliament Buildings, Toronto, Ont., will receive tenders until May 13th for all trades (except heating, plumbing and lighting) required in the erection of a Registry Office here. Plans at office of George A. Eoll and at the Department, Toronto. Cut stone and brick construction. Estimated cost, $22,000.

Gananoque, Ont.
The School Board are contemplating the installation of waterworks, sewerage systems and hot water heating in the schools. Chairman, Dr. C. H. Hurd.

Grand Mere, Que.
Tenders will be received until 4 p.m., May 19th, by the Department of Public Works, Ottawa, for the construction of a public building here. Brick, steel, cut stone and granite construction, concrete foundation, cement roofing. Plans and specifications at offices of Architects, Lafond & Denoncourt, Three Rivers, Que., and R. L. Deschamps, General P. O., Montreal, at the Post Office, Grand Mere, and at the Department, Ottawa. Specifications at office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

Halifax, N.S.
H. E. Gates, Architect, Dennis Building, Granville, will call for tenders in about two weeks for an extension to the hall of St. Mary's Y. M. T. A. & B. Society, Barrington Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $30,000.

Hastings, Ont.
Plans are being prepared for decorating and alterations to the interior of the Methodist Church. Pastor, Rev. T. Anderson, Hastings.

Humboldt, Sask.
In connection with the Court House being erected here for the Department of Public Works, Regina, sub-tenders for the millwork, painting, plastering, ornamental iron and marble work, etc., will be received by the general contractors, Parsons Construction & Engineering Company, Limited, 1712 Scarth Street, Regina.

London, Ont.
The Independent Order of Oddfellows contemplate the erection of a temple at an approximate cost of $25,000. Architect not yet appointed. For particulars, write Inspector Sanders, City Hall.

Maidstone, Ont.
Tenders for the erection of a brick school will be received until May 15th by the School Board. Architects, G. Jacques & Company, Boug Building, Windsor.

Mersea Township, Ont.
The erection of a school is contemplated by the Trustees of School Section No. 3. Architect not yet appointed. Trustee, A. Hairsine, Leamington, Ont.

Montreal, Que.
In connection with the church being built at 401 Centre Street, tenders on electrical work are being received by the Architects, MacDuff & Lemieux, 364 University Street, and tenders for the interior fittings will shortly be called for. Approximate cost of building, $20,000.

Muskoka Township, Ont.
Jonathan Groth, West Gravenhurst, will receive tenders until noon, May 15th, for construction of a stone wall under the school house in Section No. 5, Muskoka Township.

Oakwood, Ont.
Tenders will be received until May 8th by A. J. Mark, Oakwood, Secretary to the School Section No. 7, Mariposa, for the construction of a one-roomed school. Brick construction, asbestos and shingle roofing. Plans and specifications at offices of Secretary and of the Architects, Ellis & Ellis, Manning Chambers, Toronto.

Ottawa, Ont.
If sufficient funds can be raised, work will be started this year on the construction of an addition to the Misericordia Hospital, 42 Cambridge Street.

Port Credit, Ont.
The School Board are purchasing a site for a projected addition to the school. Chairman, A. Block.

Prussia, Sask.
The Trustees of School District No. 3372 have been authorized to borrow $4,000 for the erection and equipment of a school. Treasurer, N. J. Denny, Prussia.

Sault Ste. Marie, Ont.
Tenders will be received until May 13th by The Department of Public Works, Parliament Buildings, Toronto, for all trades (except heating, plumbing and lighting) required in the erection of a Jail Building here. Plans at office of the Sheriff and at the Department, Toronto. Stone and brick construction.

Shaunavon, Sask.
The Trustees of School District No. 3228 have been authorized to borrow $15,000 for the erection and equipment of a four-roomed brick school house. Treasurer, E. F. Stedman, Shaunavon.

Spruce Grove, Alta.
Tenders for the construction of a frame school will be received until noon May 15th by Peter Goebel, Spruce Grove, Secretary School District No. 3205.

Teeswater, Ont.
The Town Clerk, John Farqharson, will receive tenders until May 8th for alterations and additions to the Town Hall and for the construction of a hose tower. Frame and brick construction. Estimated cost, $4,000. Architect, G. Grey, Harriston, Ont.

Thedford Mines, Ont.
A school will be erected this summer for the Protestant School Board. A site

has been donated. Committee, Messrs. Pharo, Lipsey, McCallum and Hammersmith.

Willoughby County, Ont.
Tenders for the construction of a school in Section No. 2, will be received until May 13th by the Architect, C. M. Borter, 102 Main Street, Niagara Falls South.

CONTRACTS AWARDED

Ashton, Ont.
The general contract for the erection of a church here for the Presbyterian Congregation has been awarded to S. A. Jinkinson & Son, Ashton. Material will be purchased by the Pastor, Rev. S. B. Holmes. Approximate cost, $6,000.

Avonton, Ont.
Work has been started on the erection of a school in Section No. 7 by Allison & Moore, Stratford, Ont. White brick construction.

Birch Hills, Sask.
The general contract for the erection of a public and high school has been let to W. A. Blackadder, Birch Hills. Seating, desks and blackboards will be purchased. Approximate cost, $8,000.

Clinton, Ont.
The contract for excavation and cement work in connection wth the extension of the Library has been let by the Stavely Library Trust to Hiram Hill. Approximate cost of work, $5,600.

Elmira, Ont.
The Department of Public Works, Ottawa, Ont., has let the contract for interior fittings for the local post office to the Office Specialty Manufacturing Company, Sparks Street, Ottawa.

Hawkstone, Ont.
In connection with the construction of a church for the Presbyterian Congregation, the masonry contract has been let to W. Lee & Sons, Orillia, and the heating and plumbing contract to Philips & Company, Orillia.

The contract for carpentry work in connection with the Presbyterian Church here has been let to Hector H. Johnston and John McArthur, Orillia, and the mill work contract to S. Pomeroy.

Maisonneuve, Que.
The contract for the reinforced concrete floors and fireproofing at the Public Bath on Ontario Street has been let to the Canadian Seigwart Beam Company, Limited, 103 St. Francois Xavier Street, Montreal.

Middleton, N.S.
The contract for the installation of a heating plant in the MacDonald School has been let to Crowe-Elliott, Limited, Middleton. Approximate cost, $3,000.

Montreal, Que.
The contract for heating in connection with the church being erected at 401 Centre Street, has been let to M. Chouinard, 751 Adam Street, Maisonneuve.

Niagara Falls South, Ont.
The contract for the erection of a gymnasium for the Stanford High School has been let to Spencer & Cook. Interior fittings will be purchased by the Trustee, J. H. Gallinger, Southend P. O.

Ottawa, Ont.
Work has been started on the erection of a Boarding School for Les Chandinesses Cing Plaies, 383 Daly Street, by N. Poirer & Son, 193 Cathcart Street. Subcontracts will probably be let for plastering, painting, heating, plumbing and electrical work. Approximate cost, $18,500.

Ponteix, Sask.
The general contract for the erection of a school for the Notre Dame d'Auvergne School District No. 2369 has been let to Lockwood Bros., Regina. Desks and steam heating system will be purchased by Waterman & Waterbury Manufacturing Company, 118 Donahue Building, Regina. Approximate cost, $4,000.

Stonewall, Ont.
The contract for the installation of interior fittings in the post office here has been let by the Department of Public Works, Ottawa, to The Berlin Office & Fixture Company, Berlin, Ont.

Sudbury, Ont.
The Department of Public Works, Ottawa, have let the contract for interior fittings for the local post office to J. L. Schell Company, Alexandria, Ont.

Swift Current, Sask.
The sub-contract for plastering in connection with the Court House being built here has been let by the Provincial Department of Public Works to William Peebles. The painting contract will be let shortly.

Toronto, Ont.
The contract for excavation in connection with the erection of the St. Vincent de Paul Church at Roncesvalles and Westminster Avenues has been let to John Collins, 56 Grenadier Road. Tenders for the building will be called for about May 10th.

Weston, Ont.
Thomas Hill has been awarded a contract for the erection of a school in School District No. 4, Etobicoke Township. Brick construction, shingle roofing. Estimated cost, $4,500.

Windsor, Ont.
The electrical contract in connection with the school being built at Marion and Niagara Streets for the Separate School Board has been awarded to Gilbert Campeau, 211 Tuscazora Street.

Yorkton, Sask.
Work has been resumed on the addition to the Land Titles Office for the Provincial Department of Public Works. The brick, stone and iron work contracts have been let to Ritchie & Watters, Yorkton, the tinsmithing contract to Parrott & Byers, Yorkton, and the electrical contract to the United Electric Company, Yorkton. The Department are in the market for metal filing cabinets.

Business Buildings and Industrial Plants

Assiniboia, Man.
The Provincial Minister of Public Works, W. H. Montague, Winnipag, will receive tenders until noon, May 1st, for the erection of a telephone exchange. Concrete and brick foundation, red pressed brick construction, fireproofing, felt and gravel roofing. Provincial Architect, V. W. Horwood, 261 Fort Street, Winnipeg.

Alymer, Que.
The erection of a beet sugar plant here is contemplated by a syndicate. Work will probably start this year. Promotor, A. Gordon, M.P.

Berwick, N.S .
Woodworth Bros. have commenced the erection of a flour mill, estimated to cost $3,000 and are in the market for machinery.

Capetown, Ont.
Lawson Bros. are having plans prepared for an office and warehouse. Brick construction.

Frankford, Ont.
The evaporator of the Graham Company, Limited, Front Street, Belleville, which was recently destroyed by fire, will be rebuilt. The owners will receive prices on material and equipment.

Harriston, Ont.
George Gray & Son, Architects, Mill Street, are preparing plans for a poultry building to be erected on Margaret Street for Gunn's, Limited. Brick construction.

Honey Harbor, Ont.
In connection with the summer hotel being erected at Pinery Point, George Caswell, Coldwater, Ont., is in the market for plumbing and lavatory supplies, domestic gas supply or lighting equipment and general furniture.

Montreal, Que.
Plans are being prepared for a store to be erected on Ontario Street for Goyette Leon, 1677 Ontario Street. Estimated cost, $4,000.

Work has been started on alterations to a store on Jacques Cartier Square for converting it into a hotel for A. Desmarteau, 60 Notre Dame Street East.

New Hamburg, Ont.
The erection of an auto sales building is contemplated by D. Becker, c/o Simpson Merner. Architect not yet appointed.

Swansea, Ont.
Tenders for the carpentry work required in the erection of a frame theatre are being received by the Conness-Till Film Company, Limited, Stop 4, Lake Shore Road. Specifications with the company.

Thorold Township, Ont.
Work has been commenced on the erection of a barn for Thomas Stephenson, R. R. No. 1, Niagara Falls, South. Frame construction, concrete foundation. Estimated cost, $3,000.

Tignish, P.E.I.
The erection of a store to replace that recently destroyed by fire is contemplated by J. E. Gallant, Druggist.

Charles Murphy contemplates rebuilding the stores which were recently destroyed by fire, with an approximate loss of $10,000.

Toronto, Ont.
Work has been started on the construction of the first of three aviation sheds for Captain E. L. Janney, Glenview Avenue. Frame and galvanized iron construction.

R. M. Wallace, Church Street, has started work on alterations to a residence for stores. Brick construction.

The Toronto Hydro-Electric Commissioners, 226 Yonge Street, are receiving tenders on the erecton of a power station at Carlaw Avenue and Gerrard Street. Plans at the sub-station, Duncan and Nelson Streets. Brick and steel construction, concrete and brick foundation, felt and gravel roofing. Estimated cost, $65,000.

J. M. Cowan, Architect, 65 Adelaide Street E., has prepared plans for a coal shed to be erected at St. Clair Avenue and the C. P. R. tracks for James Muldoon, 1191 Queen Street W. Frame and galvanized iron construction.

Waterdown, Ont.

J. W. Griffen is having plans prepared for a barn and storehouse. Ironclad construction, stone foundation.

West Flamboro Township, Ont.

George Smith, Dundas, Ont., contemplates the erection of a drive shed on the Second Concession.

Winnipeg, Man.

Plans are being prepared by the City Light & Power Department for an additional storey over the King Street Power Sub-Station, for the clerical staff. Tenders will be called for shortly. Secretary to the City Council, M. Peterson. Estimated cost, $20,000.

Plans have been drawn for a stable to be built on Gordon Street, Elmwood, for Thomas Jackson & Son, 370 Colony Street. Concrete construction. Approximate cost, $4,000.

CONTRACTS AWARDED

Deacon, Man.

The contract for the construction of a cement storehouse here for the Greater Winnipeg Water District has been let to the Wolver Construction Company, 288 Smth Street, Winnipeg, at $3,453.

East Flamboro Township, Ont.

The contract for the erection of a barn for A. J. Mann, R. R. No. 2, Hamilton, has been let to Michael Hagarty, Waterdown.

Kohlar, Ont.

A barn is being erected for Mrs. Norman Koklar, by Arthur Williams & Son, R. R. No. 2, Cayuga.

Maisonneuve, Que.

The general contract for the erection of stores and workshop on Orleans Avenue for the Shawinigan Water & Power Company, 83 Craig Street W., has been let to G. D. Mitchell, Jacobs Building, and for reinforced concrete floors to the Canadian Seigwart Beam Company, Limited, 103 St. Francois Xavier Street, Montreal.

E. C. P. Guy, 694 St. Denis Street, has let the general contract for the erection of a garage on Drummond Street to J. Quinlan & Company, Limited, St. Catherine Street, Westmount. Approximate cost, $5,000.

The following contracts have been let in connection with the erection of a store at Notre Dame Avenue and Bourget Street for U. Lauzon, 1748 Notre Dame Avenue:—roofing, heating and plumbing, Daoust & Company, Notre Dame Avenue; plastering, Z. Bouchard, Notre Dame Avenue; painting, D. F. Deslauriers, 343 Richelieu Street.

Ottawa, Ont.

Ben Stapleton, Queen Apartments, has let the general contract for the erection of a theatre to H. P. Beck, 126 Sparks Street. Brick construction.

Quebec, Que.

The Paquet Company, Limited, St. Joseph Street, have awarded the general contract, masonry and carpentry contracts for the erection of a store to L. Boivin & Company, 202 Richelieu. Steel and brick construction, concrete foundation. Estimated cost, $10,000.

Work has been started on the erection of a stable on St. Augustin Street for T. Dubuc, 228-232 St. John Street, by Jos. Breton, 175 St. Oliver Street. Frame and mill construction, metal and asbestos roofing. Estimated cost, $3,000.

Raymond, Alta.

The general contract for the construction of a market building for F. Piepgrass, First Street E., has been let to C. B. Strong. Brick construction.

St. Catharines, Ont.

The masonry contract in connection with the dairy to be erected for the Sanitary Dairy Company, 5 Paul Street, has been let to Newman Bros., St. Paul St. Brick construction, concrete foundation, corrugated iron roofing. Estimated cost, $3,000.

Toronto, Ont.

A contract has been awarded to J. W. Walker, 528 Palmerston Boulevard, for the erection of a store and office building at 332 Yonge Street at an estimated cost of $19,000. Architect, J. Hunt Stamford, Ossington Avenue and Bloor St.

J. M. Watkin, 326 Shaw Street, has let a contract for the erection of an addition to a store and residence on Dovercourt Road to A. H. Scott, 1678 Dufferin Street. Brick construction, felt and gravel roofing. Estimated cost, $5,000.

Purton & Chennels, 106 Alcina Avenue, have commenced the erection of a pair of stores and residences at 832 to 834 Bloor Street West for J. H. Hill, 451 Grace Street, at an approximate cost of $5,000. Brick construction, felt and gravel roofing.

Welland, Ont.

The electrical contract in connection with the stores and residences being erected for John Bosak, 528 Main Street, has been awarded to Harvey McCoombs, Fonthill, Ont.

Work has been started on the erection of a store and residence on North Main Street for Dominic Santone by W. H. Hickey, 1 Main Street East. Tile and brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,200.

Winnipeg, Man.

In connection with the erection of three stores at Main and Pacific Streets, the roofing contract has been let to Christie Bros., 521 Henry Avenue; plumbing and heating contract, to Beaisto Heating & Plumbing Company, Fort Street, and the electrical contract to Schumacher-Gray & Company, Phoenix Building.

Residences

Aylmer, Ont.

H. Z. Balcom has commenced the erection of two residences on Sydenham Street at an estimated cost of $4,500. Frame and brick construction, shingle roofing.

Barrie, Ont.

W. C. Thompson has had plans drawn for a residence by J. M. Cowan, 65 Adelaide Street E., Toronto. Brick construction, slate roofing. Estimated cost, $3,500.

Berwick, N.S.

Work is about to start on the erection of a frame residence for Mrs. Rainsforth.

The erection of a residence for Mrs. A. S. Fisher will shortly be commenced.

Charlottetown, P.E.I.

M. P. Hogan, Great George Street, is about to build two residences at Weymouth and Dorchester Streets. Existing building is being razed. Concrete foundation, frame construction, shingle roofing. Approximate cost, $4,000.

The erection of a residence for E. Nicholson, Box 236, has been commenced by day labor. Concrete foundation, frame construction, shingle roofing. Estimated cost, $3,500.

Chatham Township, Ont.

Plans of a residence have been drawn for W. Wilcox, R. R. No. 1, Eberts. Work will be started by day labor about May 1st. Estimated cost, $5,000.

Eel Ground, N.B.

The Department of Indian Affairs, Ottawa, Ont., will receive tenders until June 7th for the erection of a teacher's residence here. Plans and specifications at the post offices, Newcastle and Chatham, Ont., with the Indian Superintendent, Boctouche, and at Eel Ground School.

Guelph, Ont.

Tenders will be received until May 15th by H. G. Cockburn, Park Avenue, for the erection of three residences. Brick and stone construction. Approximate cost, $9,000.

Halifax, N.S.

Work is about to start on the construction of a residence and barn for H. Douglas, Protestant Industrial School. Estimated cost, $3,200.

Hensall, Ont.

Plans for a residence to cost about $3,000 will be prepared by G. H. Follick. Frame and brick construction, shingle roofing.

Humber Bay, Ont.

J. M. Cowan, Architect, 65 Adelaide Street E., Toronto, has prepared plans of a pair of residences for John Maloney. Brick construction, shingle roofing. Estimated cost, $6,000.

Ilderton, Ont.

James Paisley, 12 London Township, Ilderton P. O., is preparing plans for a residence to be erected at a cost of about $3,500. Frame and brick construction, stone and concrete foundation, shingle roofing.

Kimberley, Ont.

Jasper Stewart has commenced the erection of a residence. Milton pressed brick construction. Estimated cost, $5,000.

Milverton, Ont.

A. C. Clemens has purchased a site for a residence on Main Street. Construction may be started this summer.

Montreal, Que.

Louis Charron, 1371 Amity Street, has had plans drawn for a residence to be erected on Hochelaga Street. Estimated cost, $3,500.

Niagara Falls, Ont.

R. Brigham, River Road, has commenced the erection of a residence. Pressed brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

North Bay, Ont.

Work has been started by day labor on the erection of a residence for E. L. Banner. Frome and brick construction. Estimated cost, $6,000. Architect, Angus & Angus, Angus Block.

Ottawa, Ont.

Tenders will be called for shortly on the erection of a residence for P. J. Powers, 432 Wellington Street, Stucco construction, shingle roofing. Estimated cost, $6,000. Architect, F. C. Sullivan, Castle Building, Queen Street.

D. Maritz, 28 Stonehurst Street, is considering the erection of a residence. Frame construction, felt and gravel roofing.

Prices on plastering, painting, heating, plumbing and electrical work required in the erection of a residence are being received by Frank Linton, 7 Centre Street. Estimated cost, $5,500.

G. A. Clark, 106 Kent Street, has commenced the erection of a residence on McDonald Street. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $3,500.

Plans have been drawn by W. E. Noffke, Plaza Building, Rideau Street, for alterations and additions to apartments on Elgin Street for W. S. Halliday, 20 Arlington Street. Tenders will be called for about September 1st. Approximate cost, $6,000.

George Welsh, Craig and Findlay Streets, contemplates the erection of a residence.

Work has been started on the erection of a residence on Sunnyside Street by A. E. Toms, 125½ Bank Street. Sub-contracts will probably be let for plastering, painting, heating, plumbing and electrical work. Approximate cost, $6,000.

Quebec, Que.

Work has been started on the erection of a residence at Cartier Avenue and Lafrane Street by N. Cauchon, 59 Dorchester Street. Concrete foundation, brick construction, metal, felt and gravel roofing. Estimated cost, $12,000.

Gaudias Cantn, 22 Lee Street, has commenced the erection of a residence. Concrete foundation, frame construction, metal and asbestos roofing. Estimated cost, $2,500.

F. Guilmet, 180 St. Therese Street, has commenced the erection of a brick and frame residence at an approximate cost of $8,000.

P. Breton, 24 Latourelle Street, is building a residence for J. E. Rochette, 352 St. Valier Street. Frame and brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $3,000.

Ridgetown, Ont.

Watson & Taylor have commenced the erection of two bungalows. Frame construction. Approximate cost, $3,000 each.

Plans of a residence, estimated to cost $3,000, are being prepared by E. L. Mitton.

Sault Ste. Marie, Ont.

L. J. Cooper, 270 Queen Street, contemplates the construction of two residences. Estimated cost, $2,000 each.

St. John, N.B.

Work is about to start in the erection of apartments at Elgin and Metcalf Streets for Mrs. G. Kimball, 138 Metcalf Street. Concrete foundation, frame construction, felt and gravel roofing. Estimated cost $3,600.

Sydney, N.S.

The erection of a residence is being considered by J. Fraser MacKenzie, Reserve Mines, N.S. Approximate cost, $3,700.

Thorold Township, Ont.

Work has been started by day labor on the erection of a residence for C. T. Ware, R. R. No. 1, Niagara Falls South. Brick construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Toronto, Ont.

Work has been started on the erection of a pair of residences at 52-54 Greenwood Avenue for J. Price, 100 Greenwood Avenue. Estimated cost, $5,000.

John Price, 100 GreenWood Ave., has commenced the erection of a pair of residences at 121-123 Greenwood Avenue. Approximate cost, $5,000.

Work has been commenced by J. Cooper, 70 Fulton Street, on the erection of a pair of residences on Queen Victoria Street. Brick construction. Estimated cost, $4,000.

A residence is being built at Braemore Gardens and Christie Street by S. H. Thomas, 55 Ellsworth Avenue. Brick construction, stone foundation. Estimated cost, $5,000. Smaller trades may be let.

J. W. Butchart, 1 St. Ives Avenue, is erecting a residence on St. Leonards Boulevard, at an estimated cost of $5,000. Smaller trades wll be sub-let.

Work has been started on two pairs of residences at 114-120 Arundel Avenue by J. Lucas, 919 Carlaw Avenue. Brick construction, shingle roofing. Approximate cost, $15,000.

Work has been started on the erection of a pair of residences on Gothic Avenue for F. Scudmore, 62 Pacific Avenue. Brick construction, stone foundation. Estimated cost, $8,000.

A. & A. Grant, 837 Logan Avenue, have commenced the erection of a pair of residences at Browning Avenue and Jackman Street. Brick construction, shingle, felt and gravel roofing. Estimated cost, $5,500.

L. C. Patton, 327 Brock Avenue, has had plans drawn by M. D. Klein, 169 Ashdale Avenue, for two pairs of residences to be erected at Ashburnham and Elmwood Streets. Brick construction. Approximate cost, $10,000.

W. Williams, 33 Cloverdale Avenue, is building a residence at 138 Wallace Avenue, at an estimated cost of $4,000. Brick construction, shingle roofing.

R. Seal, 108 Browning Avenue, will receive tenders for the smaller trades required in the erection of a pair of residences at 110-112 Browning Avenue. Brick construction. Estimated cost, $8,000.

J. W. Clare, 68 Ascot Avenue, is about to build a residence at 1759 Dufferin Street. Stone construction. Estimated cost, $3,500.

F. McConvey, 18 Toronto Street, has started work by day labor on the erection of a pair of residences on Talbot Street. Brick construction, shingle, felt and gravel roofing. Estimated cost, $3,500.

C. Hough, 16 Kensington Avenue, is building a residence at 13 Gordon Avenue, at an estimated cost of $4,000. Smaller trades will be sub-let.

Doner & Weis, 1456 Davenport Road, are about to commence the erection of two pairs of residences at Rushton and Alice Avenues, York Township. Brick construction, stone foundation, shingle roofing. Estimated cost, $12,000.

Work has been started on the erection of a residence at 62 St. Andrews Gardens by R. Doherty, 56 St. Andrews Gardens. Brick construction, slate roofing. Estimated cost, $6,000.

R. Doherty, 56 St. Andrews Gardens, is building a residence at 483 Summerhill Avenue, at an estimated cost of $3,300. Brick construction, shingle roofing.

Work has been commenced by R. J. Cole, 159 Ellsworth Avenue, on the erection of a residence on Northcliffe Boulevard. Brick construction. Estimated cost, $5,000.

Uxbridge, Ont.

The erection of six residences at Cooper and Toronto Streets is being considered by J. Stone, Contractor, St. Catharines.

Waterdown, Ont.

A. W. Palmer is having plans prepared for a brick residence to be erected on Mill Street.

Willowdale, Ont.

Mountain & Walker, 53 Hounslow Heath Road, Toronto, are receiving tenders on the plumbing, plastering, heating, wiring and tar and gravel roofing required in the erection of a pair of residences on Parkview Boulevard, Willowdale. Plans at the job.

Tenders on the stucco and plastering required in the erection of a residence on Parkview Boulevard are being received by H. F. Chapman, Willowdale P. O.

A residence is being built on Parkview Boulevard for H. Branscombe, c/o Ross & Branscombe. Brick veneer construction, shingle roofing. Estimated cost, $3,000.

Work has been started by C. C. Lewis, 121 Seaton Street, on the erection of a residence on Empress Boulevard. Some of the smaller trades will be let. Approximate cost, $3,500.

Windsor, Ont.

Tenders will be received until May 12th for the erection of a residence for A. J. Campeau, Wyandotte Hotel. Brick foundation, brick veneer construction, shingle roofing. Architects, G. Jacques & Company, Boug Building. Approximate cost, $5,000.

Winnipeg, Man.

A. Simpson, 168 Arlington Street, contemplates the erecton of four residences on Arlington Street, at an estimated cost of $12,000.

The erection of a residence on Dominion Street at an estimated cost of $4,600 is being considered by G. Desrosiers, 501½ Desmeurons Street, Norwood.

The West End Realty & Building Company contemplate erecting a number of high-class residences in the west end and Fort Rouge. Manager, N. Herchenson, 169 Lilac Street.

A Simpson, 168 Arlington, has had plans prepared for four residences to be built at Arlington and Preston Streets at an estimated cost of $12,000. Work will start shortly.

(Continued on page 55)

Tenders and For Sale Department

TOWN OF ST. LAMBERT

Tenders for Pavement

Tenders are invited for the laying of Concrete Pavement, Street Asphalt and Asphaltic Concrete Pavement, on concrete base for seventeen (17) streets in the Town of St. Lambert, and approximately amounting to 58,000 square yards. Plans and specifications may be seen and form of tender had at the office of the Town Engineer on and after the 3rd day of May, 1915.

The Town reserves the right to reject the lowest or any tender.

E. DRINKWATER, Town Engineer,
Town Hall,
St. Lambert, P.Q.

3

Tenders for Filtration Plant

Public Utilities Commissioners of the Town of Brockville, Ont.

Sealed tenders, marked "Tender for Filtration Plant," will be received by C. R. Deacon, Esq., Chairman of the Public Utilities Commission, Brockville, until 5 p.m., **May 17th, 1915**, for the construction of a Mechanical Filtration Plant.

Plans and specifications may be seen, and forms of tender obtained at the office of the undersigned.

The lowest or any tender not necessarily accepted.

G. H. BRYSON,
Town Engineer.

Brockville, April 26th, 1915. 6

TENDERS

SUPPLIES

Tenders will be received through registered post only, up to noon on **Tuesday, May 11th, 1915**, for the supply of:—

No. 48. Red Lead Paint for Bloor Street Viaduct.
No. 50. Asphalt Pump Outfit for City Plant, Princess Street.
No. 51. Additional Equipment for Car Bodies, Lansdowne Avenue.
Car Line Extension, Toronto Civic Railway.
No. 52. Car Heaters and Seats, Gerrard Street Equipment, By-law 5626.

Tenders must be addressed to the Chairman, Board of Control, City Hall, Toronto, and be plainly marked on the outside of envelope as to contents.

Specifications and forms of tender may be obtained at the Works Department, City Hall.

Tenderers must comply strictly with conditions of City By-law as to deposits and sureties as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control

Toronto, April 27th, 1915. 2

CITY OF STRATFORD

Sealed tenders, marked "Tenders for Sewer Pipe," will be received by the undersigned up to five o'clock p.m., **Saturday, May 15th, 1915**, for the supply and delivery of approximately:

5,460 lineal feet of 48-inch Reinforced Concrete Sewer Tile.

6,200 lineal feet of 36-inch Reinforced Concrete Sewer Tile.

Forms for tender and any other information may be obtained from the office of the City Engineer.

Tenders must be accompanied by a marked cheque as called for in the specification.

Tenders will also be received for alternative materials.

The lowest of any tender not necessarily accepted.

A. B. MANSON,
City Engineer.

6

To Contractors

Sealed tenders marked "Tenders for Buildings," addressed to the undersigned, will be received at this Department until **Thursday, May 13th, 1915**, for the building of a gaol at Sault Ste. Marie, and a Registry Office at Fort William (excepting heating, plumbing and lighting.) Plans and specifications for the Gaol can be seen at the office of the Sheriff, Sault Ste. Marie, and for the Registry Office at the office of Geo. A. Eoll, Fort William; and also at this Department. An accepted bank cheque payable to the Honorable F. C. Macdiarmid, Minister of Public Works, for Five Per Cent. of the amount of the tender, and the bona fide signatures and addresses of two sureties, or the name of a guarantee company approved by this Department, willing to provide bond for the due fulfilment of the contract, must accompany each tender. The Department is not bound to accept the lowest or any tender.

By Order, H. F. McNAUGHTEN,
Secretary Public Works Department.

Newspapers publishing this advertisement without authority, will not be paid for it.

Toronto, April 30th, 1915.

18 Department of Public Works, Ontario.

WANTED

One End Cut Hollow Brick Die; one side-cut die; one side cutting table. State price and full particulars. Thompson Bros., Windsor, Ontario. 18

ENGINEER

Ten years' experience on construction work, reinforced concrete, sewers, intakes, foundations, dredging (dipper, hydraulic, ladder), cost data, draughting, timekeeping, etc. Best of references. Box 191, Contract Record & Engineering Review, Toronto. 18-19

SALES AGENTS WANTED

Large U. S. firm making steel and wire products wants sales agents in both Eastern and Western Canada. Lines include metal wheels and axles, farm wagons, tractor trucks, log and freight wagons, portable mountngs for machinery, etc. Box 197, Contract Record, Toronto. 17-18

FOR SALE

A Bargain, Parsons Trenching Machine almost new. Digs to twenty feet deep and up to five feet wide. Box 196, Contract Record, Toronto. 17-19

FOR SALE

A bargain, 75 Ton Vulcan Shovel in good condition; or will consider exchange for Revolving Shovel of approved type, in first class condition. Write Standard Crushed Stone Company, Limited, 53 Queen Street, Niagara Falls, Ont. 15-18

Board of Education

Sealed new tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, May 14th, 1915

for

Administration Building

College Street

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender, or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than **4 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

MILES VOKES,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer.

3

Corrosion of Steel in Concrete

Speaking on the subject some time ago, Dr. W. H. Walker, director of the Research Laboratory of Applied Chemistry, of the Massachusetts Institute of Technology, said that every engineer is well aware of the fact that acidulated water, no matter how small the percentage of acid may be, tends to corrode steel by increasing the number of hydrogen ions present. It had been made clear, from tests he carried out, that there were certain alkaline substances present in concrete which corrected any acidity, and so protected the contained metal work from corrosion.

This fact has an important bearing upon the question whether concrete will protect iron or steel from corrosion. Inasmuch as Portland cement, when it sets or hardens, liberates a quantity of caustic lime, which is a strong alkali, the answer to the question must be in the affirmative. Iron or steel will not corrode when embedded in good concrete. But caustic lime is soluble in water, and poorly made concrete is not impervious to moisture. Therefore, if iron be embedded in concrete through which water is allowed at anp time to percolate, this calcium hydrate will be slowly but surely dissolved. With it will disappear the inhibiting action of the concrete; and iron embedded therein will, in time, rust and become corroded. To ensure absolute protection of the reinforcing members of concrete construction, therefore, such concrete must be of good quality and sufficiently dense and carefully made to render it waterproof.

Residences

(Continued from page 54)

CONTRACTS AWARDED

Charlottetown, P.E.I.

The general contract for the erection of a residence on Elm Avenue for H. H. Horne, c/o Horne & Company, has been let to Brooklyn Vail, Charlottetown. Concrete foundation, frame construction, shingle roofing. Estimated cost, $3,000.

Dobbinton, Ont.

The general contract for the erection of a dwelling for Arthur Slomskie has been awarded to Thomas Ash. Brick construction, stone foundation, shingle roofing. Estimated cost, $3,000.

Dundas, Ont.

John Wilson has awarded the masonry and plastering contracts in connection with the residences being built for him to Herbert Scott, and the carpentry contract to Ritchie & Fletcher.

Galt, Ont.

James Douglas, Cedar Street, has let the general contract and carpentry contract in connection with the erection of a residence at George and Salisbury Streets to G. Murray, Victoria Avenue, the brickwork and masonry contracts to W. McKaig, Ball Avenue, and the plastering contract to W. Mogg, Brant Road.

The following contracts have been let in connection with the erecton of a residence on Brant Road for Miss Dickson, Rose Street: masonry, T. Hancock, Wellington Street; carpentry, P. Nichols, Market Street; plastering, W. Mogg, Brant Road; heating and plumbing, Scott & Bennett, Water Street N.

Halifax, N.S.

J. W. Kedy, 138 Cunard Street, has been awarded the contract for the erection of flats on LeMarchant Street for G. F. Ring, Francklyn Street. Approximate cost, $5,000.

Hamilton, Ont.

In connection with the erection of three residences on Railway Street for Solomon Wright, 27 Railway Street, the general contract, carpentry, masonry, steel and roofing contracts have been let to M. Levy, 213 Park Street W. Other trades not let.

The masonry contract in connection with the erection of a residence on Hamilton Avenue for R. Phillips, 481 King Street E., has been let to B. Barnes, 53 Cheener Street, and the carpentry and roofing contracts to P. Gemmel, Lamoreaux Street. Other trades not yet let.

The following contracts have been let in connection with the erection of a residence on Garfield Avenue for G. Shutliff, Wentworth Street North:—general contract, carpentry, steel and roofing to Sparks & McKay, Fairhold Road South; masonry to J. Ponstie, Whtfield Avenue; painting to C. J. Hartnup, 69 Aikman Avenue; heating and plumbing to J. Allen, 324 East Avenue North. Plastering and electrical contracts not yet let. Estimated cost of dwelling, $3,000.

Levis, Que.

The general contract for the erection of a residence on Wolfe Street has been let by J. Samson, to Joseph Blais, Levis. Approximate cost, $6,000.

Lindsay, Ont.

The contract for the erection of residences for F. Giffin has been let to Neil Grey. Brick construction.

Work has been started on the erection of four residences for L. V. O'Connor and J. O'Reilly by Neil Grey. Brick construction.

Minnnedosa, Man.

The erection of a residence for C. T. Mickle will be commenced at once by W. Scott, Minnedosa. Material will be purchased by the owner. Approximate cost, $7,000.

Montreal, Que.

In connection with the residence being erected on Madison Avenue for F. C. Connolly, 774 St. Dominique Street, the contract for plastering has been let to F. A. Sims, 454 Madison Avenue, and for painting to A. Graig, 41 Jurors Street.

The general contract for the erection of a residence on Oxford Avenue for W. A. McQuestin, c/o the N. K. Fairbanks Company, Limited, 46 St. Alexander Street, has been let to Salisbury & Popham, 354 Madison Avenue.

New Waterford, N.S.

The general contract for the erection of a glebe house for St. Agnes' Parish has been let to J. McIsaac, Glace Bay. Estimated cost, $5,000.

Ottawa, Ont.

The general contract for alterations to apartments on Laurier Street for Dr. Milton Graham, 227 Clemow Avenue, has been awarded to Shuttleworth & Black, 24 Euclid Avenue. Brick veneer construction, shingle roofing. Estimated cost, $7,000.

The contract for converting a building on Metcalfe Street into apartments for Mrs. J. Cameron, 122 Argyle Avenue,

Canadian Made Roofings for Canadian Buildings

We manufacture in Canada roofings of all sorts. We make roofing for factories—ready roofing or built-up roofing, also asphalt shingles.

NEPONSET Paroid Roofing

is one of the best known of our brands. It is, however, only one of a large line.

We also make NEPONSET Wall Board, the most practical substitute for laths and plaster that has ever been put on the market. It is made in several finishes and its surfaces have been waterproofed, so that it is all ready to apply and needs no further decoration.

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Bird & Son,
Department R,
Hamilton, Ont.

Please send us the following information in regard to your roofing and wall board:

Name ...

Address ...

BIRD NEPONSET PRODUCTS

Bird & Son, Hamilton, Ont.

Established 1795

Warehouses—Montreal, St. John, Winnipeg
Calgary, Edmonton, Vancouver.

has been let to Louis Bangs, 18 Glen Avenue. Brick veneer construction, felt and gravel roofing. Approximate cost, $7,000.

The general contract for the erection of a residence on Fairmount Street has been let by V. V. Rogers, Limited, 193½ Sparks Street, to W. H. Craig, 4th Avenue. Brick will be supplied by Peerless Brick Company, Ottawa Square. Estimated cost, $4,600.

Peterboro, Ont.
A Bellegham, 190 Hunter Street, has let the general contract, masonry, carpentry and roofing contracts for the erection of a residence at 43 Dennistown Avenue to W. J. Johnston, 63 Aylmer Street. Other trades not let.

Quebec, Que.
J. B. Cote, 323 St. Oliver Street, has let the general contract, masonry and carpentry contracts in connection with the erection of a residence on the Avenue des Erables to C. Jobin, 168 Latournelle Street. Brick construction, concrete foundation, metal and asbestos roofing. Estimated cost, $7,000.

G. E. Morissette, Limited, 208 Latournelle Street, have commenced the erection of a residence on the Avenue des Erables for E. Morissette, at an approximate cost of $7,000. Brick construction, concrete foundation, felt and gravel roofing.

The general contract and masonry contract in connection with the residence being built for O. Parent, 103 Third St., has been let to J. B. Verret & Fils, 184 Third Avenue, Limoilou. Estimated cost, $6,000.

Sault Ste. Marie, Ont.
Work has been started on the erection of a dwelling in the Eaton Sub-dvision for Leslie Johnston, 8 Herrick Street, by William Oben, Murray Street. Approximate cost, $3,000.

St. John, N.B.
Charles Robinson, 131 Victoria Street, has let the contract for the erection of a residence on Bryden Street to Herbert Brown, 86 Sumner Street. Estimated cost, $3,200.

Toronto, Ont.
The following contracts have been let in connection with the erection of a residence on Glen Grove Avenue East for F. A. Roe:—masonry, Elgie & Page; carpentry, J. E. Almond; plastering, Bremner & Porter; roofing, W. C. Gurney; painting, Taylor & Company; plumbing and heating, McNaughton & McKenzie; electric wiring, Dolson & Palmer; hardware, Aikenhead Hardware, Limited.

In connection with the residence being built at 70 Dearbourne Avenue by W. A. Bulley, 632 Parliament Street, the carpentry contract has been let to Kay Bros., 28 Enderby Road. Smaller trades will be let. Estimated cost, $4,500.

Work has been started by L. J. Bland, 18 Vermont Street, on the erecton of a residence on Cortleigh Crescent for F. G. Marriott, 27 Lytton Boulevard. Hollow tile and brick construction. Approximate cost, $5,000.

W. A. Neate, Architect, 518 Clinton Street, has let the general contract for the erection of a residence at 55 St. Andrews Gardens to Neate & Sons, 518 Clinton Street, and the masonry contract to W. Montgomery, Humber Bay. Smaller trades will be sub-let. Estimated cost, $5,500. Owner's name withheld.

In connection with the residences being built at 87 North Markham Street, York Township, by J. Cameron, the carpentry contract has been let to James Stewart, 627 Crawford Street, and the heating contract to the Pease Foundry Company, 118 King Street E. Approximate cost, $5,000.

Work has been started on the erection of a residence on Regal Road for G. W. Elliott, by H. A. Johnston, 67 Belhaven Road. Brick construction, concrete foundation. Estimated cost, $4,500.

Waterdown, Ont.
The general contract for the erection of a residence for J. W. Griffen has been let to Slater & Copp, and the masonry contract to M. Hagarty. Estimated cost, $4,000.

Westmount, Que.
In connection with the erecton of a residence on Wood Avenue for H. R. Popham, 384 Wood Avenue, the following sub-contracts have been let:—plastering, F. A. Sims, 454 Madison Avenue, Montreal; heating and plumbing, A. Morrow, 1408 DesErables Street, Montreal; painting, A. Craig, 41 Jurors Street, Montreal; electrical work, W. Flood, 99 Hutchison Street, Montreal. Roofing and interior fittings not let.

Power Plants, Electricity and Telephones

Holbeck, Sask.
Tenders will be received until 8 p.m., May 8th, by E. H. Joll, Secretary to Kincora Rural Telephone Company, Holbeck P. O., for (1) material and labor complete, and (2) labor only required in the construction of a telephone system.

North Grimsby Township, Ont.
By-laws have been carried providing for the construction of a lighting system on Queenston and Grimsby Roads by the Dominion Power & Transmission Company, Limited, Hamilton.

Sherbrooke, Que.
The City Council will expend $27,000 in the purchase of meters, controllers, etc. No tenders will be asked. Clerk, W. E. C. Gatien.

CONTRACTS AWARDED

Avonlea, Sask.
The Avonlea Rural Telephone Company have let the contract for the construction of a telephone system to W. D. Craig, Princess Theatre Block, Regina, at $2,600.

Westmount, Que.
The City Council have awarded the contract for the supply of lamps and standards to John Watson & Son of Montreal Limited, 167 Wellington Street, Montreal.

Fires

Belleville, Ont.
Fire has destroyed a barn belonging to George Brown, Lime Street.

Birtle, Man.
Barns belonging to J. Farmer have been destroyed by fire. Loss, $10,000, with little insurance.

Bracebridge, Ont.
The residence of C. Charles, Hunt's Hill, has been destroyed by fire. No insurance.

Brandon, Man.
The farm residence of Alfred Attridge, twelve miles southeast of this place, has been destroyed by fire. The loss, $5,000, is covered by insurance.

Campbellton, N.S.
A store and residence on St. Andrews Street belonging to Arthur Hussey have been destroyed by fire.

East Angus, Que.
The upper portion of Mrs. James Miller's residence, Cookshire Street, has been destroyed by fire.

Estevan, Sask.
W. J. Johnson's residence and barn have been completely destroyed by fire.

Fingal, Ont.
The dwelling of J. Lethbridge, South Road, has been destroyed by fire, with a loss of $3,000, covered by insurance.

Florence, Ont.
The residence of A. A. Cook, has been destroyed by fire. The loss is partially insured.

Grafton, N.B .
The residence of Nathaniel Clowes has been destroyed by fire. Loss $3,000, partly covered by insurance.

Miscellaneous

Belleville, Ont.
The Town Council contemplate the purchase of road oil. Clerk, J. W. Holmes.

Belmont, Ont.
Gas mains are being laid here for the Southern Gas Company, and will be continued to Ingersoll and Hamilton. Lamps will be purchased by the Company. Manager, F. B. Tomb, Central Avenue, London.

Hagersville, Ont.
The Town Council will purchase road oil this summer. Clerk, J. T. Park.

St. Catharines, Ont.
The purchase of an auto fire truck is being considered by the City Council. Clerk, J. W. Pay.

Slough & Bush, St. Paul Street, are about to convert a garage into a factory for the manufacture of shrapnel shells, and are in the market for the necessary machinery.

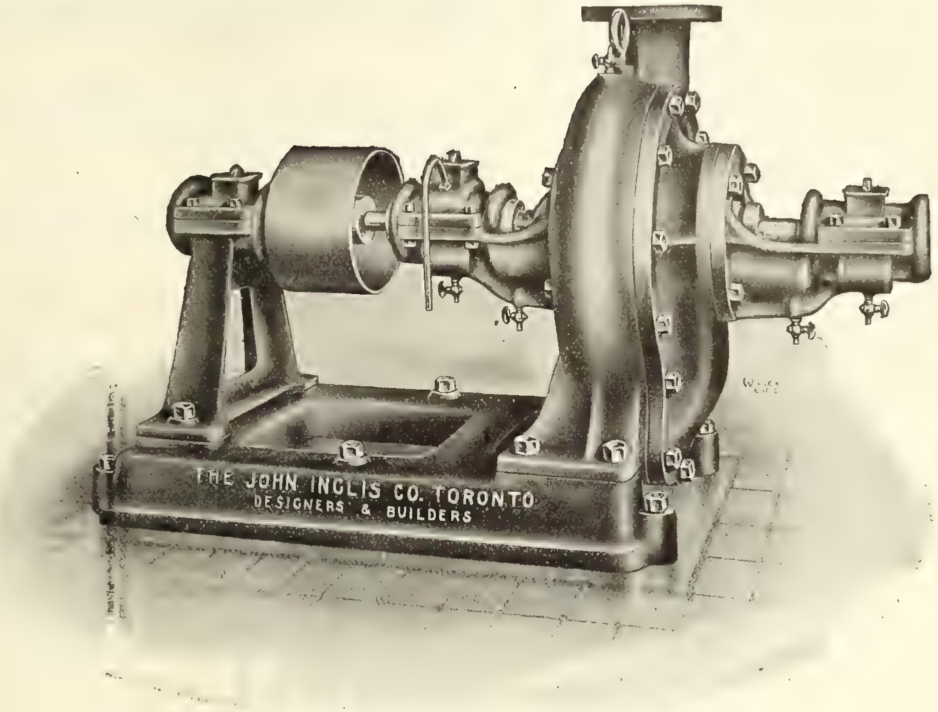
Toronto, Ont.
Tenders will be received until May 6th by the Board of Education for the supply of science apparatus, chemicals, etc. Specifications at the office of the Clerk of Supplies, City Hall.

The Board of Control will receive tenders until May 11th for an asphalt pump outfit for the City plant, Princess Street. Plans and specifications at the office of the Works Department, City Hall.

Tenders will be received until May 11th by the Board of Control for additional equipment for car bodies for the Lansdowne Avenue extension, car heaters and seats, and equipment for the Gerrard Street line. Plans, etc., at the office of the Works Department, City Hall.

Weyburn, Sask.
The following amounts are included in the current estimates of the fire department:—booster pump, $4,600, and fire alarm system, $4,536. Clerk, E. H. Phillips.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

INGLIS' PRODUCTS ARE "MADE IN CANADA"

Write us for prices.

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Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

JAMES THOMSON, President. J. G. ALLAN, Vice-President. JAMES A. THOMSON, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.
LIMITED

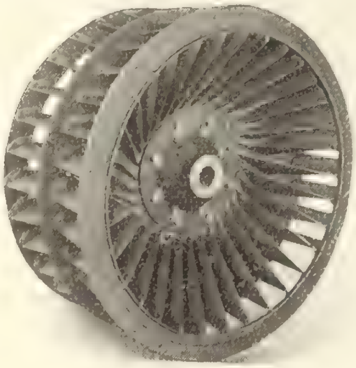
Manufacturers of

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

Keith Fans



The opportunity for greater economy and efficiency in **Heating and Ventilating** is emphasized in the **"Keith" Fan.** Comparative tests of other types of fans have resulted in the **"Keith"** being proclaimed the most efficient and economical in the Fan World. Write for our New Catalogue No. 55.

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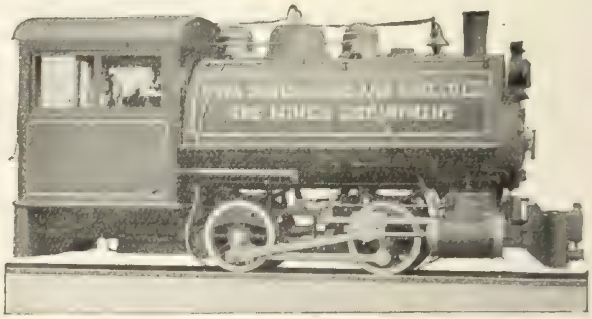
Messrs. ROSS & GREIG, 412 James St., Montreal, Que.
Messrs. WALKER'S LTD., 259-261 Stanley St., Winnipeg, Man.
Messrs. GORMAN, CLANCEY & GRINDLEY, LTD., Calgary and Edmonton, Alta.
Messrs. ROBERT HAMILTON & CO., LTD., Bank of Ottawa Bldg., Vancouver, B. C.

INDUSTRIAL LOCOMOTIVES



The designs of our small locomotives are the result of wide experience.

All details are accurately finished to standard gauges and are absolutely interchangeable on all locomotives of the same class and size.

This cuts out long delays when parts wear out, as parts liable to wear can be kept on hand or shipped promptly from our works.

MONTREAL LOCOMOTIVE WORKS, LIMITED
DOMINION EXPRESS BUILDING, MONTREAL, CANADA

BISHOPRIC STUCCO BOARD

makes Stucco and Plaster Walls warm, dry and permanent.

Plaster or cement applied to Bishopric Stucco Board wedges tight into the dovetailed spaces between the bevel-edged laths, forming "keys" that are stronger than can possibly be made on wood or metal lath. The heavy layer of Asphalt-Mastic in the Stucco Board makes walls absolutely wind and damp-proof, and therefore warm. And the cost is surprisingly low.

Write for samples and particulars about Bishopric Stucco Board, Lath Board and Sheathing, and Permatite Roofing, to

The Bishopric Wall Board Co., Limited, Office and Factory: **938 Bank St., Ottawa, Canada**

RAILS New and Relaying Switches, Turntables, Etc.

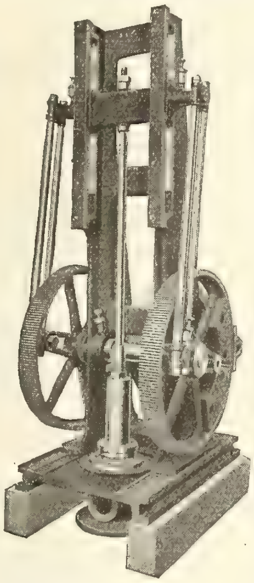
Carried in Stock

Locomotives and Cars

Jno. J. Gartshore, Toronto

Water Supply from Deep Wells

is obtained at a minimum cost by use of our deep well pumps.



Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer.

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Lawrenceburg, Indiana, U. S. A.

Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS**, Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

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Specify

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of

Insulating Underground Pipes

Save time, labor and future trouble and **insure highest efficiency** not only for a few months but for **all the time.**

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The Ric-wiL Underground Pipe Covering Company
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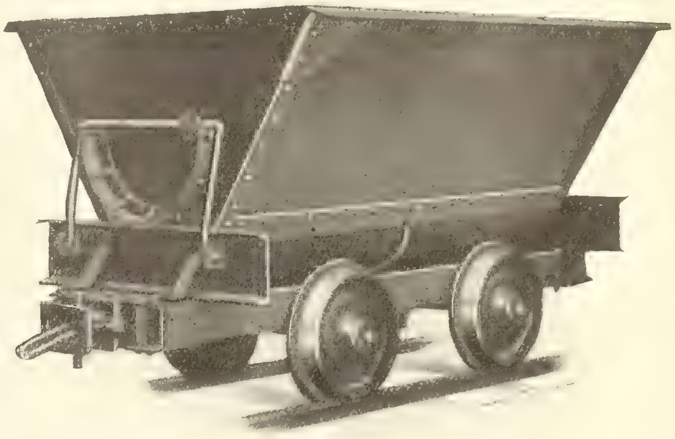
Steel Dump Cars

Any Size or Design
Workmanship Guaranteed
Prompt Delivery Prices Moderate



(Car Dumps Either Side)

Let us Quote on Your Requirements.

Marsh & Henthorn, Limited

Belleville, Ontario

$45. GARROW

CONTRACTORS' ACETYLENE FLARE LIGHT

The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The Sudbury Construction & Machinery Co., Ltd.

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Canada Wire & Cable Co., Limited

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Bare and Insulated Electrical Wires for all purposes.

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Prompt shipments from Factory or nearest warehouse.

Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

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Lime, Sewer Pipe and Fire Brick

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The "PANAMA LINE" of Road Machinery, Road Graders, Levellers and Drags

is the most complete line of practical Road Machinery made in Canada

GRADERS

- Panama Giant (traction) 3300 lbs.
- Panama Standard (6 horse) 2800 lbs.
- Panama Boston (2 or 4 horse) 1000 lbs.
- Panama Jr. Improved (2 horse) 600 lbs.

SCRAPERS

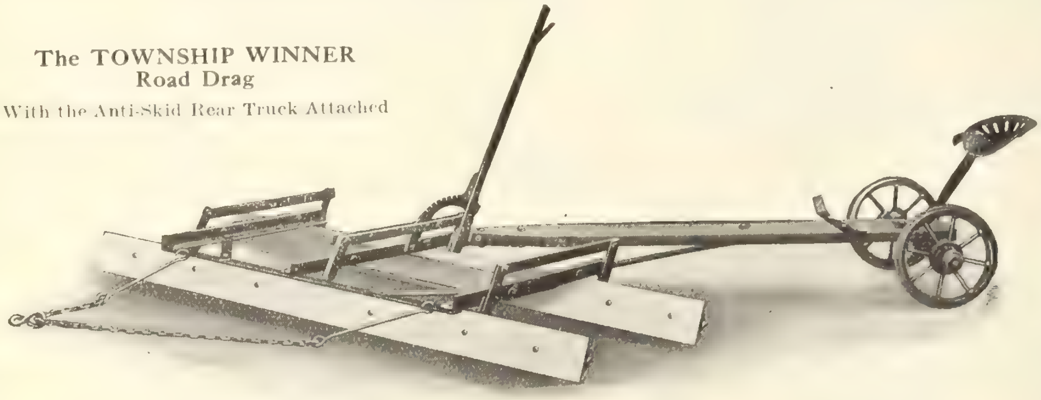
Panama Drag Scrapers Panama Wheeled Scrapers

DRAGS

3-Way Drag No. 1 3-Way Drag No 2
Township Winner, 8 ft. Township Winner, 7 ft.
Panama No. 1 Panama No 2 Simplex

CAST IRON AND CORRUGATED CULVERTS

A FULL LINE OF CONCRETE MACHINERY



The TOWNSHIP WINNER
Road Drag
With the Anti-Skid Rear Truck Attached

THEY ARE ALL SAYING THE SAME

"Last Spring we purchased from the Exeter Mfg. Co., Limited, one Panama Jr. Improved Grader and one Township Winner Drag with truck. The members of our Council Board were all surprised that this grader would do the heavy grading that we did with it. This is all the road machinery we have in our town and we have been able to keep our streets in excellent condition with the use of these two machines."
(Signed)
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If you want Service, Get the PANAMA JR. IMPROVED. Don't Get the "Just as Good."

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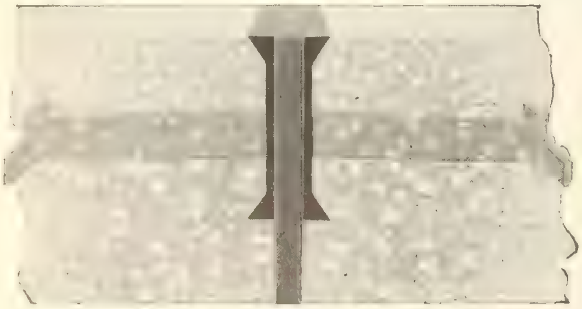
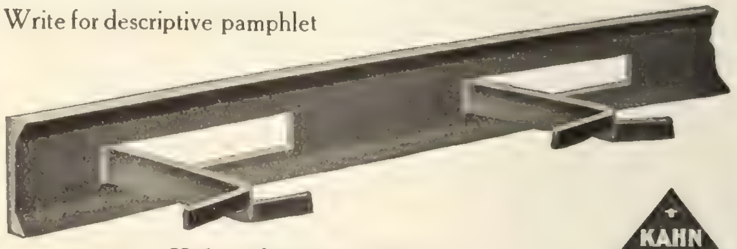
KAHN ARMOR PLATES for CONCRETE ROADS



Cross sectional view showing joint protected by Kahn Armor Plates with filler between them.

Write for descriptive pamphlet



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The Beveled Edge Protects the Concrete

KAHN SYSTEM Building Products

TRUSSED CONCRETE STEEL CO. OF CANADA, LIMITED, Walkerville, Ont.

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Beams—Channels
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Always in Stock

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STANDARD STEEL CONSTRUCTION CO.
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WELLAND - CANADA
MANUFACTURERS AND ERECTORS

Steel Buildings and Bridges

STRUCTURAL STEEL FOR QUICK DELIVERY

We carry in stock at Montreal 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

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Estimates furnished promptly, Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
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"AMERICAN" Enameled Brick

Write for catalogue, also samples, miniature or full size.

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VANCOUVER WOOD PIPE & TANK CO., LTD.
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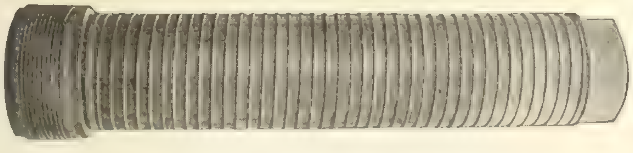

Contractors for Waterworks Construction, Manufacturers of Wire-Wound Wood Pipe, Continuous Stave Pipe, Tanks, Silos, Steam Casing.

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CULVERTS

Last for Years and Years

Moisture alone is a corrosive element.

But when the water flowing through a culvert contains other natural corrosive elements, such as alkali and acid for instance, the need for a corrosion-resisting culvert is further emphasized.

TONCAN METAL

Combats Rust and Corrosion

A culvert made of Toncan Metal Sheets is economical, because it is
1st—Rust and Corrosion-resisting
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Conclusive and satisfying evidence of Toncan Metal's durability is contained in the 'Text Book on Corrosion." Write for it.

The Pedlar People, Limited
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The Stark Rolling Mill Company
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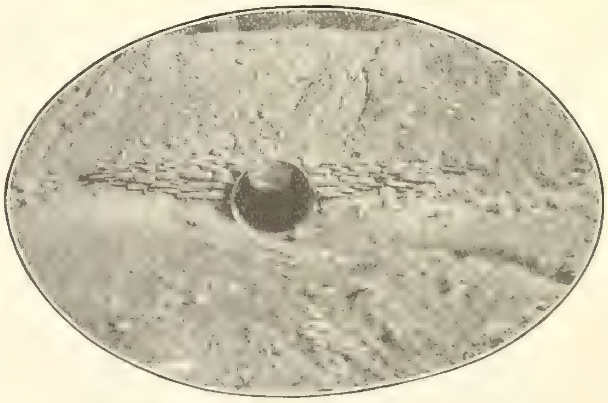

No fill too deep for a Toncan Metal Culvert.

To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

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Reinforced Concrete Pipe

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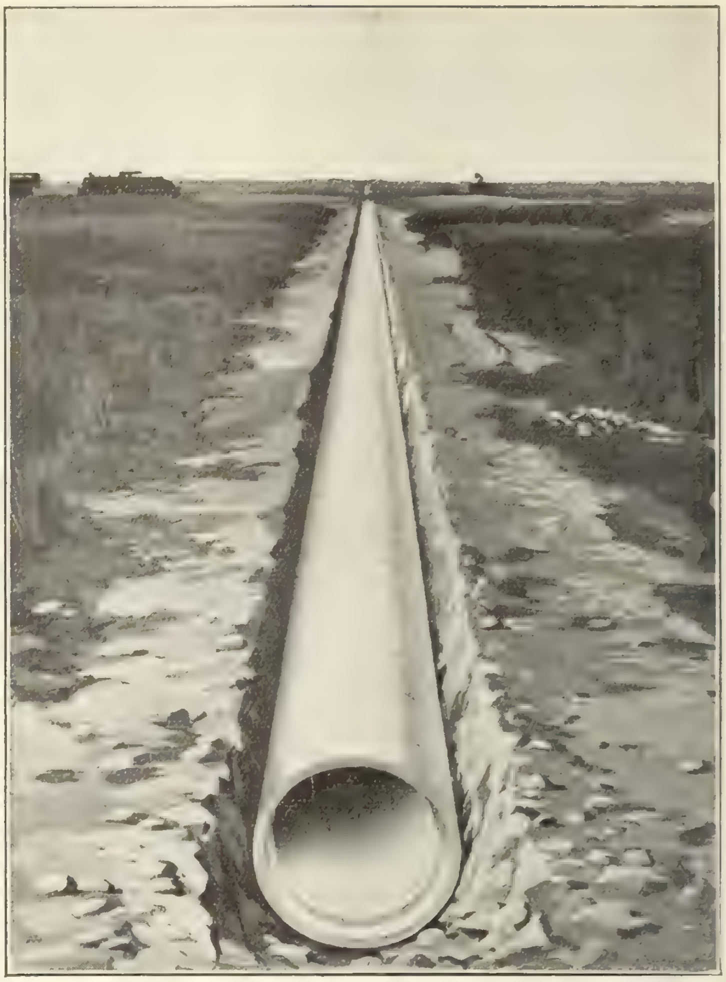
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.



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That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

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That is Clean, Tough Stone of a Quality suitable for Macadam Road and Concrete

We can supply you in any size or quantity.
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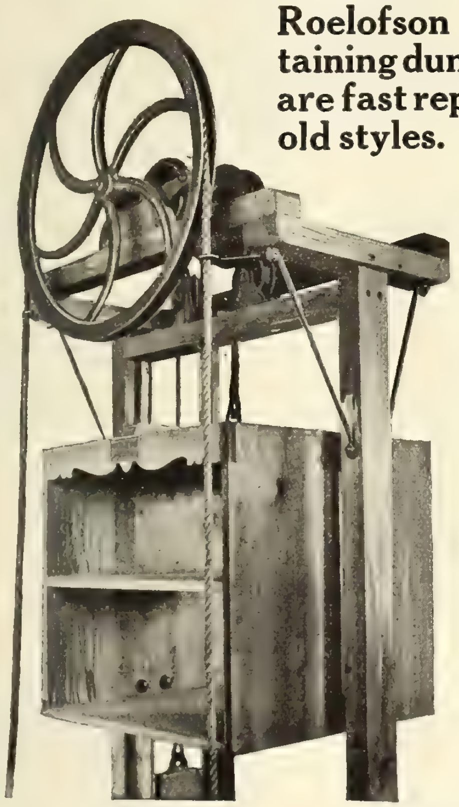

Roelofson self retaining dumb waiters are fast replacing the old styles.

They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of cost for special machines to be used as wall hoists, freight or invalid elevators.

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Unsurpassed for waterproofing foundations and preventing rust and corrosion on exposed iron and metal work.

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The Ideal House Wire

should possess maximum dependability and durability, and be sold at a price which justifies its use in all classes of buildings.

"Sterling"
Rubber Insulated Wire

meets these requirements to a degree that entitles it to the consideration of every thoughtful architect, engineer, contractor and user.

Get our prices before buying anywhere.

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Manufacturers of Electric Wires and Cables of all kinds for all services, also Cable Accessories.

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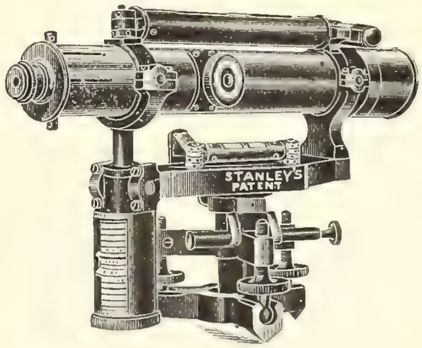

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The Largest Manufacturers of Surveying and Drawing Instruments in the World.

Drawing Office Stationery of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our catalogue "K 91" and compare our prices with those of other *first-class* makers.

W. F. Stanley & Co., Limited
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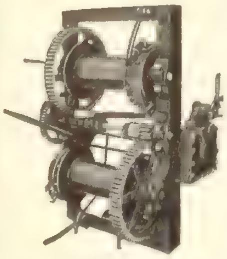
STEAM and AIR ENGINES, HOISTING ENGINES, STEAM CRANE HOISTS, MOTOR CRABS, SWINGING ENGINES, DRILL HOISTS, SPUD HOISTS, MARINE MACHINERY


Motor Crab

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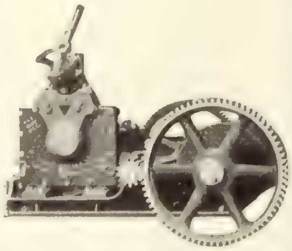
Dake Engine Co.

Grand Haven, Mich.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Sand, Gravel and Crushed Stone

Lime
Cement
Plaster
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Fire Clay
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During the past few months we have supplied ornamental lighting standards for the following places:—

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Windsor, Ontario
Outremont, Quebec
London, Ontario
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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

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Estimates on application

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel -$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $21; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22; No. 2 Hemlock, dimension and 1 in., $19 to $21.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $42; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $27; No. 1 pine decking D 2 S, $28; spruce decking, $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casin, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $3.40 to $4.50; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.40; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14; 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $4.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto proces (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime $9.5d to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 81c. per gal of 9 lbs.

Raw linseed oil—in bbls., 78c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bbls., 73c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.85; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.60. Circular plates—Flange quality, 30-in. dimensions and over, $2.70; under 30-in. dimensions, $3.00. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.60; 28-in. $5 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.75 per 100 lbs.; Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14½c basis per pound; British manilla, 12½c basis; African hemp, 12½c; sisal rope, 10½c basis; lath yarn, 9¾c. Boiled linseed oil—in barrels, 82½c per gal. of 9 lbs. Raw lin seed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles. beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
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BAR STEEL

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For the best results from gypsum products—specify "Pillar Brand." This brand of hardwall plaster is mixed with the highest grade goat and cattle hair, thoroughly washed and specially prepared. It makes a hard, clean, substantial wall.

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Shipments by rail or water.

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Head Office, Sydney, N. S. *Mills,* Iona, N. S.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page (66))

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 30 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $35 at warehouse, $33 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35; fire clay, $12 per ton.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $5.35 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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Dredging and Excavating Machinery
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On work where exacting and uninterrupted service is of vital importance, the Contractor who knows, uses BEATTY Hoists because of their proven RELIABILITY.

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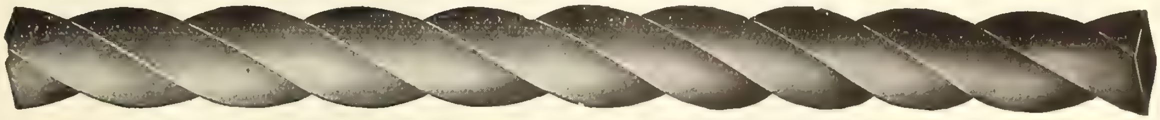


STEEL BARS
for Reinforcing Concrete

Rounds, Squares, Flats, Twisted Squares, Angles, T-Bars, Ovals, Half Ovals, Half Rounds, Bands, Special Sections.

3/4″, 7/8″ and 1″ Channels for use with Metal Lathing

CROSS ARM BRACES—POLE SHIMS

Plain and Galvanized

Prompt Shipment from Stock

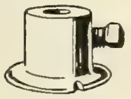


Fig. 1

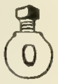


Fig. 2

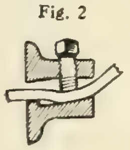


Fig. 3

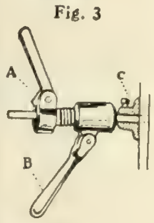


Fig. 4

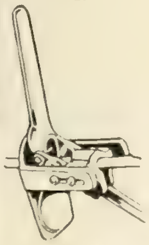
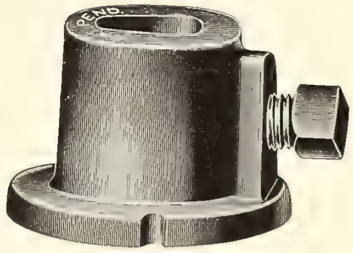


Fig. 5

Use UNIVERSAL CLAMPS
to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section, showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screws tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

One Clamp for walls, columns and soffits This clamp is literally *universal* in application. With these low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

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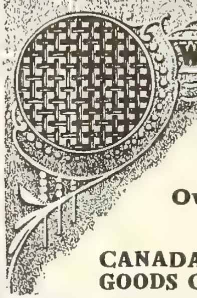

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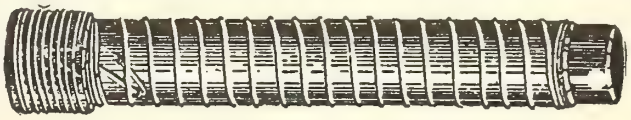

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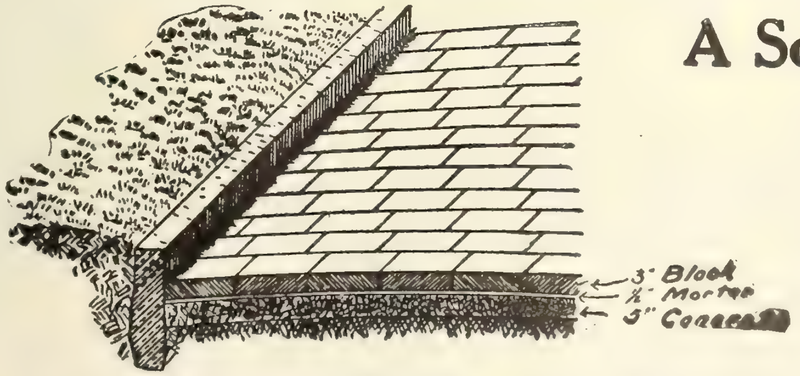

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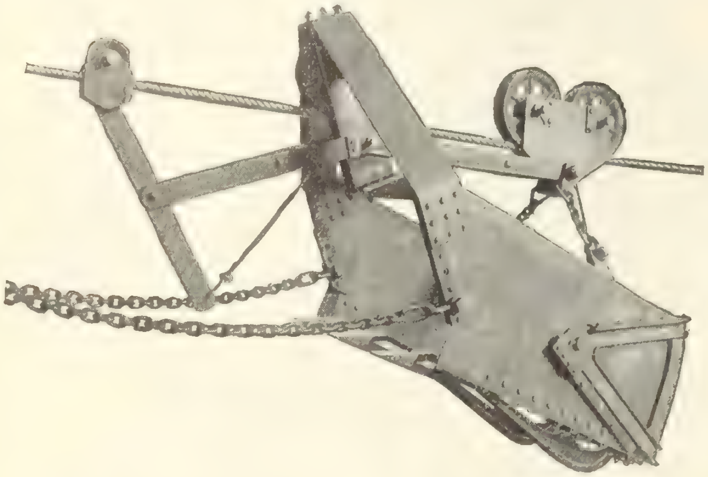

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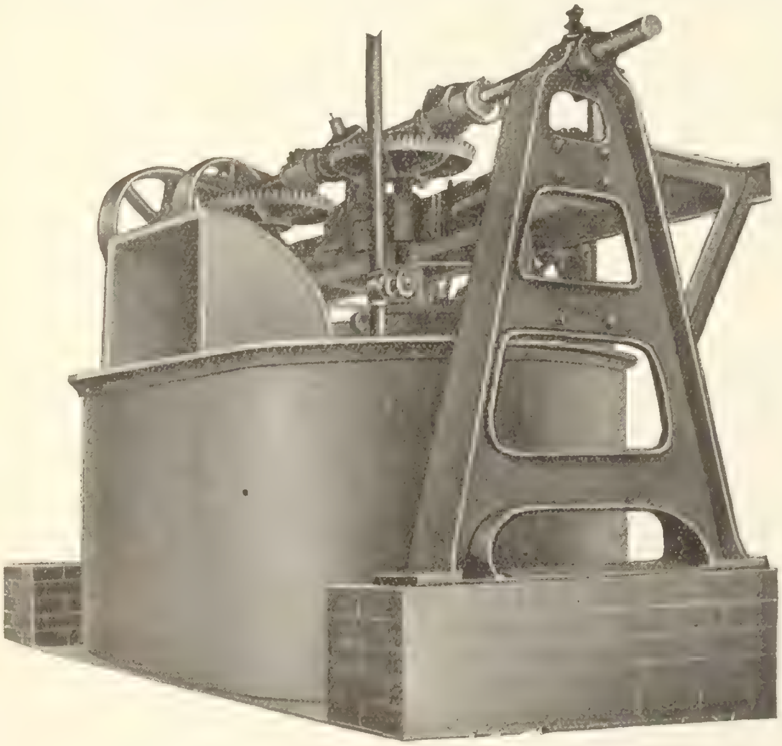

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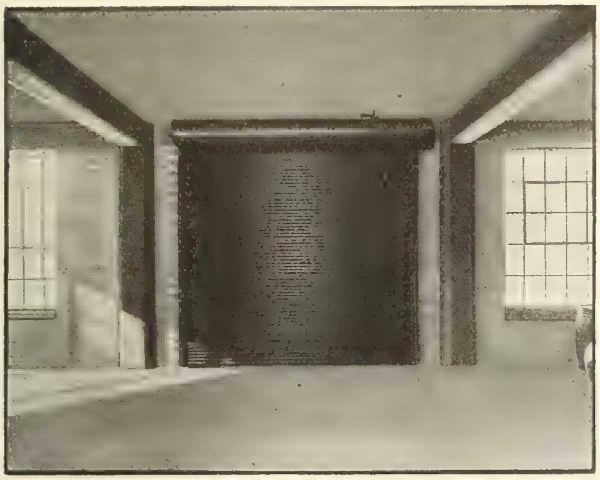

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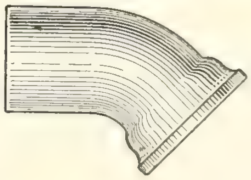

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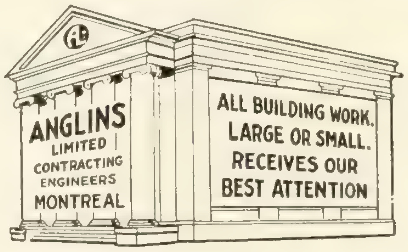
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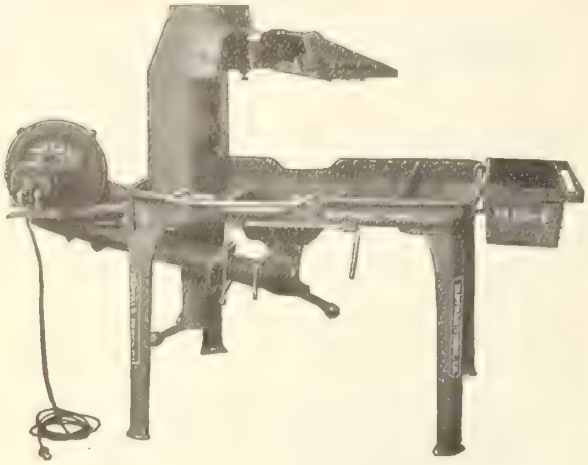

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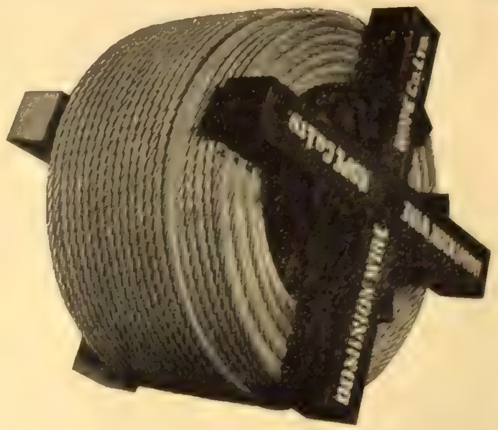

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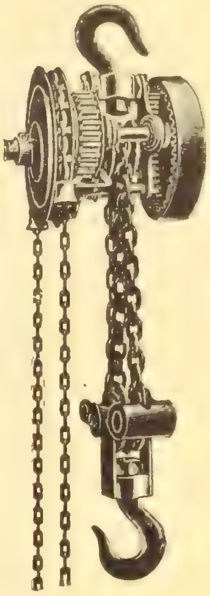
Aikenhead's

Spiedel Chain Hoist



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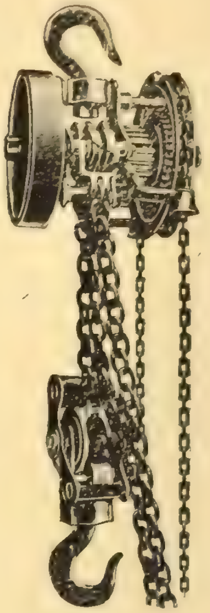

Fig. 2
Hoist showing lower block in position for fast speed.

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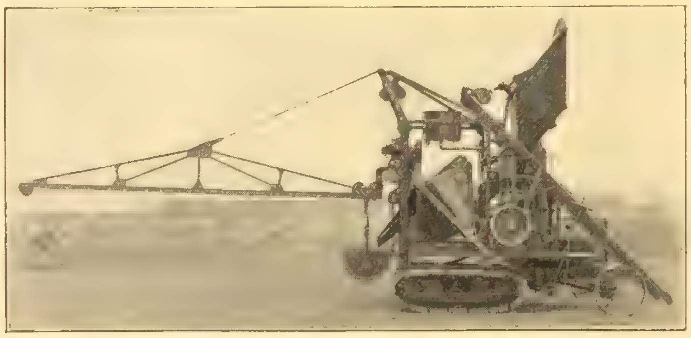

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Two prominent corners in Toronto
The Terra Cotta for both buildings was
manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

Chicago - Illinois

Agencies in all the large cities of Canada.

TOCKOLITH
AND
No. 49 R. I. W.

Were selected in preference to all other preparations for the protection of all structural steelwork in the "World's Highest Building."

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BECAUSE no other materials on the market combine the same high resisting qualities, ease of application and permanency of protection as the "R. I. W." Products. **That's why** the Metropolitan Tower, Singer Bldg., Bankers' Trust Bldg., Pennsylvania Terminals and the majority of other world famous structures throughout America are permanently protected by **Toch Brothers' Materials.**

Copy of Red Book and Tockolith Booklet will be gladly furnished upon request to nearest distributor or

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(Toch Bros., Est. 1848)
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COVERS THE CONTINENT

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Hard Wall Plaster

HARD-WALL PLASTER HAMMER BRAND HILLSBOROUGH, N.B.

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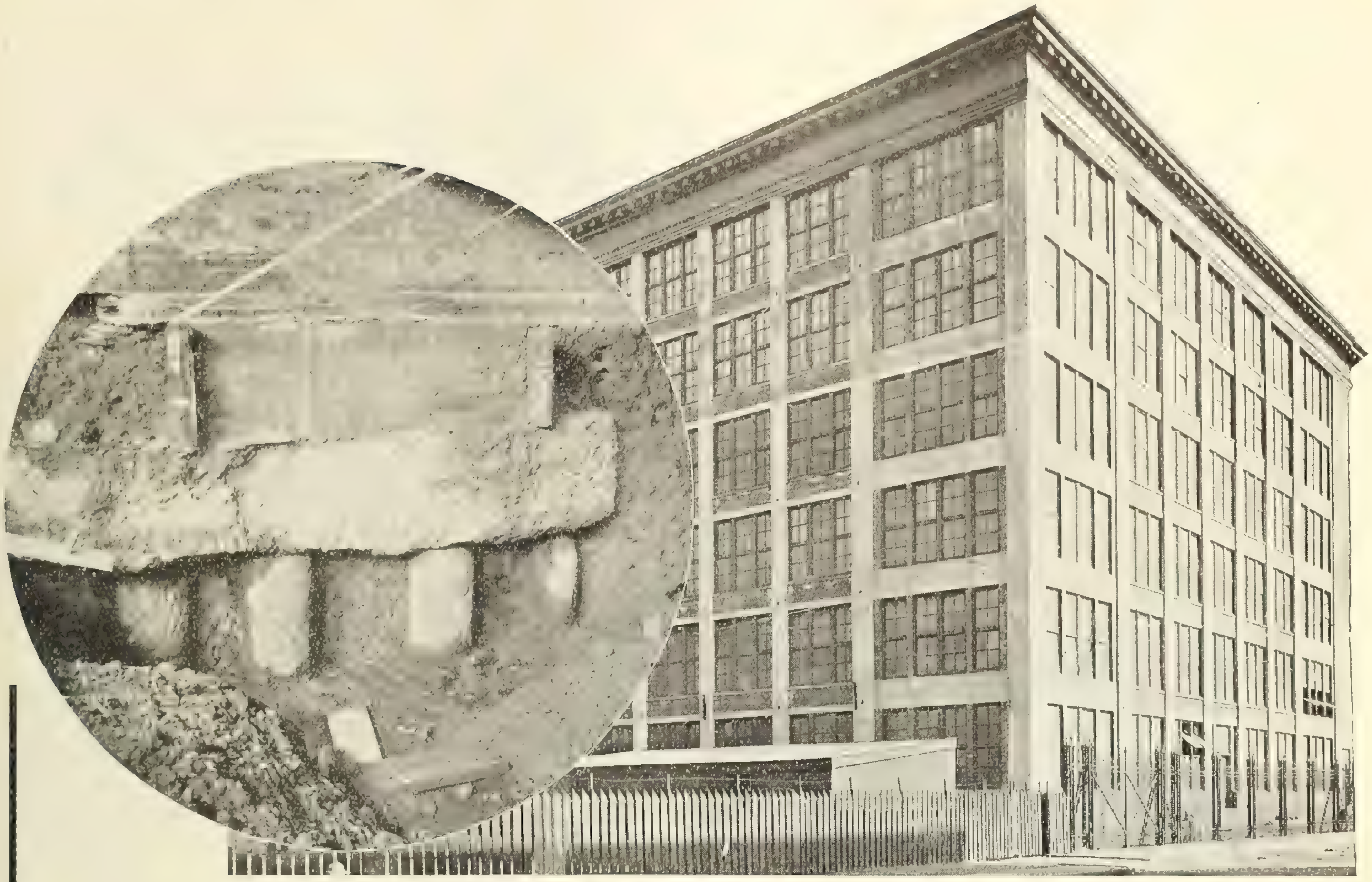

Drive to Firm Footing and Bond to the Soil

THE SIMPLEX SYSTEM comprises three methods which are adapted to any soil conditions. The distinguishing feature of all of them is **penetration.** You can get your piling down to bed-rock or solid footing. Simplex Piles are **straight** piles and compress the soil uniformly from ground surface to pile point.

The illustrations show the cabinet shop building of the Victor Talking Machine Company, at Camden, N. J.; 493 Simplex Standard Piles support this building. When the plant was extended in 1912, Simplex Piles were used again. The excavation made for the new building furnished another evidence of the bond developed between the Standard SIMPLEX Pile and the surrounding soil. Simplex Piles have been in service 11 years.

For docks, wharves and other waterfront work the SIMPLEX MOLDED PILE, a strongly reinforced concrete pile, is set on a couple of feet of fresh concrete placed in the bottom of the driven Simplex shell. SIMPLEX MOLDED PILES **require no driving or jetting.**

Over half the concrete piles in the world are SIMPLEX PILES.

The Simplex does not depend upon skin friction for its strength. It drives to a firm footing first, then it takes full advantage of the skin friction developed by cementing itself to the surrounding soil.

The STANDARD Simplex Pile which is adapted to most soil conditions and is generally used, comprises a heavy steel shell with a detachable point which is driven preferably with a drop-hammer. This shell drives quickly and easily. It stands the strain of heavy driving. When it finally brings up, the form is filled with soft concrete and then pulled out, leaving the point in the ground. The concrete, forced down at the bottom by its own weight, completely fills the hole and cements itself to the **evenly Compressed** ground all the way down.

The "Composite" Pile is designed to cheaply meet soil conditions requiring great penetrations.

There is a SIMPLEX PILE for every job.

Write for the useful illustrated reference book, "Simplex Concrete Piling."

Simplex Concrete Piling Company of Philadelphia

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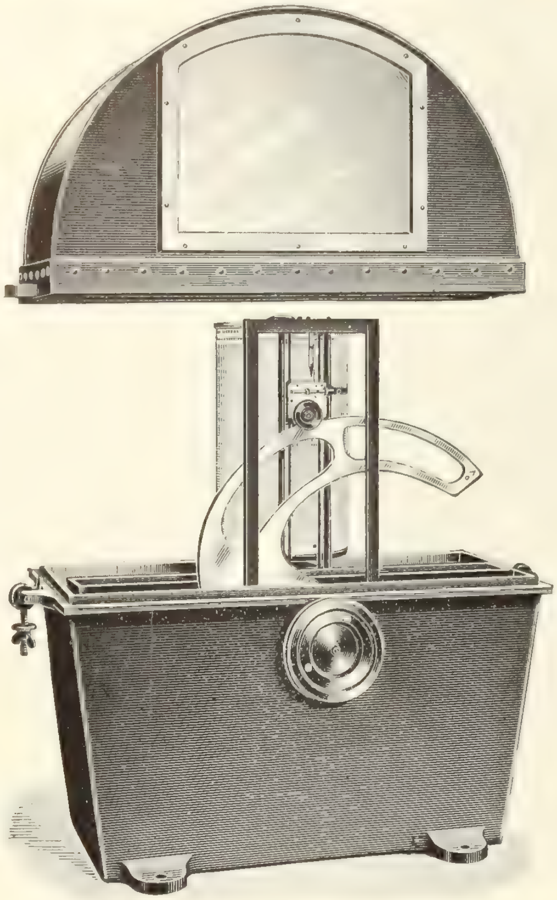
Simplex Construction Company, Limited

Coristine Building, MONTREAL

"Simplex Piles Drive to Firm Footing"



CAM RECORDERS

For recording the quantity of water or sewage flowing over a sill or through a notch. A strong, reliable instrument, not liable to derangement, and of the best manufacture and finish. Easily installed because no elaborate levelling is required.

Send for Book No. 6

which contains fullest information about all classes of Water Level Apparatus.

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Leicester, England

KERR

Gate Valves
and
Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited

WALKERVILLE, ONTARIO

8 x 8 x 24 inch Granite Rock Face Block

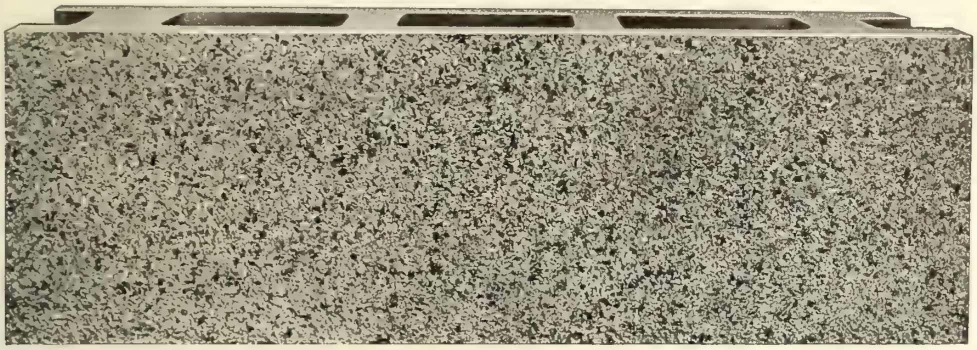
Molds for Casting

Waterproof Hollow Cement Building Blocks

With Granite Faces

THEY COST LESS — THEY SELL FOR MORE
YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited **(Zagelmeyer System)**
298 Howard Avenue, WINDSOR, ONTARIO

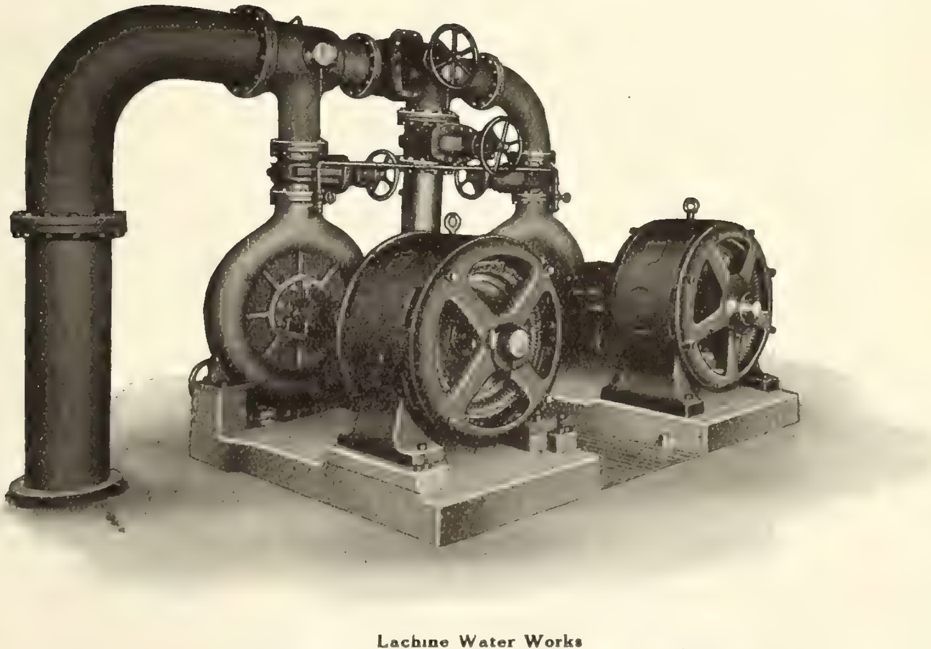
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

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Take advantage of this offer to-day—while it is open to you. Insure yourself the privilege of examining these reports. See how the MacLean Service will help you increase your business and decrease the cost of getting it and handling it. Fill in the form below and mail it to-day.

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Sewers and Sewage Disposal.
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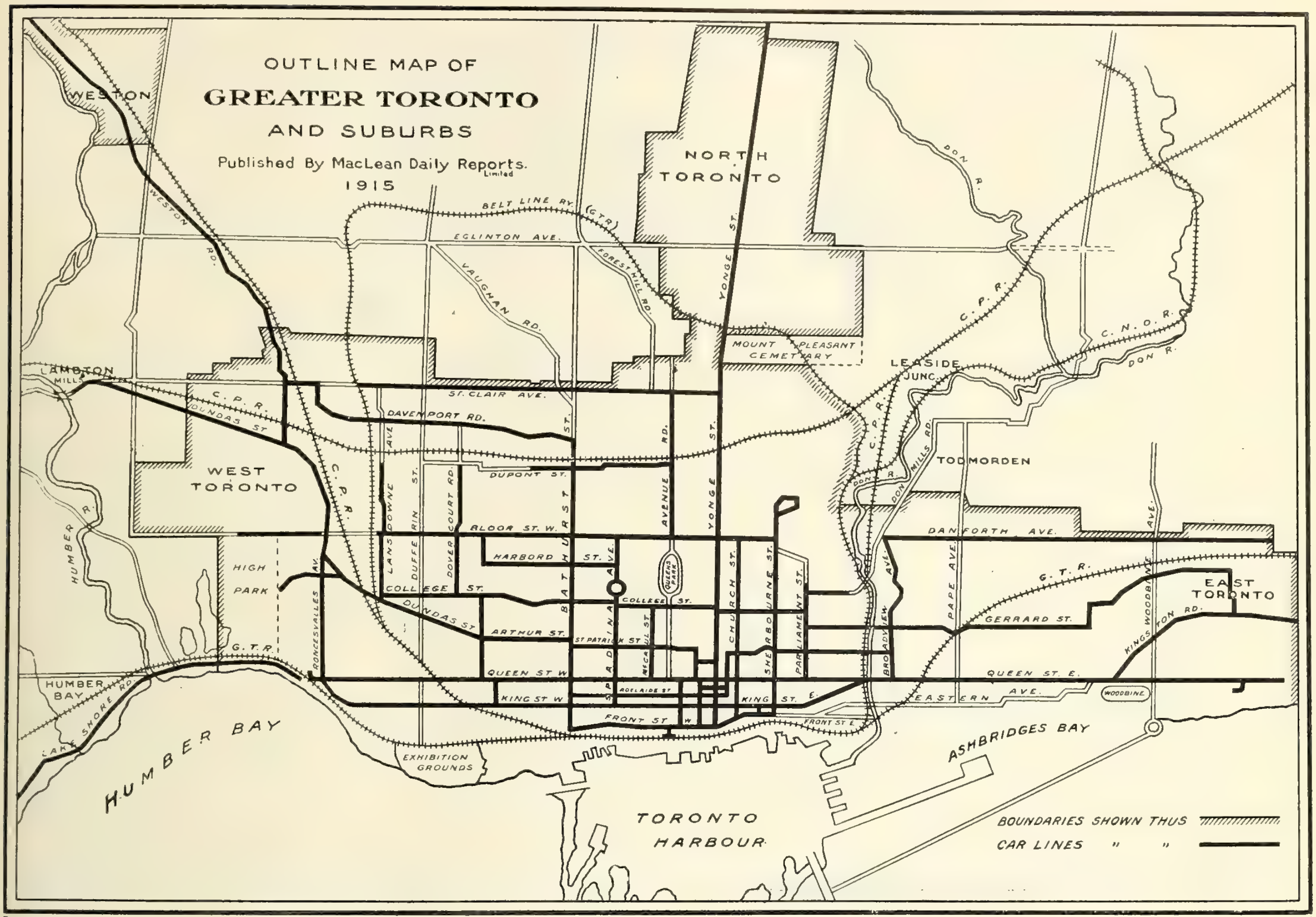

Look at the Map—

Toronto covers a wide area. East Toronto, Rosedale, Eglinton and West Toronto are far apart. The city is so big and distances so great that it must take a lot of your time going about just **looking for prospects**. Costs a great deal of money to make the rounds, visiting jobs, watching for excavations, canvassing architects, waiting in outside offices, doesn't it? Why not save this time and keep this money in your pocket?

You can do it by using MacLean Daily Reports. Our service will tell you every day of several places where you might secure business. Each morning your postman will bring you a letter containing from five to ten reports on Toronto jobs that you can get right after. These will tell you the names and addresses of owners, architects and engineers, location of the work, its estimated cost, size, construction, etc. That's what you want to know, isn't it? We will tell you when tenders are called, and advise you to whom contracts are awarded. Each report will state how far the work has progressed. Understand, all these facts will be right up to the minute, for our staff of reporters will have visited the job or verified the information the day before.

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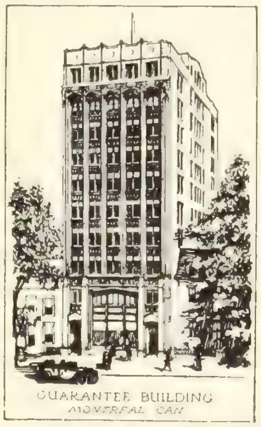


GUARANTEE BUILDING
MONTREAL CAN

A Typical Installation in Montreal—

The Guarantee Building, Montreal, (Architect, Kenneth G. Rea), is another of the numerous buildings in Canada in which is installed a G & G Telescopic Hoist for the removal of ashes.

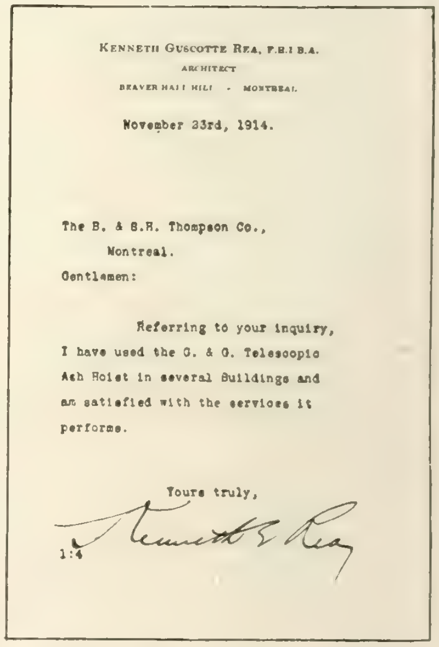
Made in Canada

The G&G PATENTED Telescopic Hoist with compound gear and brake attachment

Raises a maximum load of 500 lbs. at an actual speed of 30 feet per minute. It is not only speedy, but also clean, convenient and noiseless in operation.

The G & G Telescopic Hoist is operated from the sidewalk. This form of construction safeguards the public against falling into hatch and protects operator from injury should anything drop through the hatch. When not in use the hoist telescopes and no part shows above street level. Every hoist subjected to thorough working test before shipment.

Write to nearest agent for Booklet and Prices.



KENNETH GUSCOTTE REA, F.R.I.B.A.
ARCHITECT
BEAVER HALL HILL - MONTREAL.

November 23rd, 1914.

The B. & S.H. Thompson Co.,
Montreal.

Gentlemen:

Referring to your inquiry, I have used the G. & G. Telescopic Ash Hoist in several Buildings and am satisfied with the services it performs.

Yours truly,
Kenneth G. Rea
1:4

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Toronto

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Montreal

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"MADE IN CANADA"

Complete
Stationary or Portable
Rock Crushing
Plants

Elevating and
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Dump Wagons
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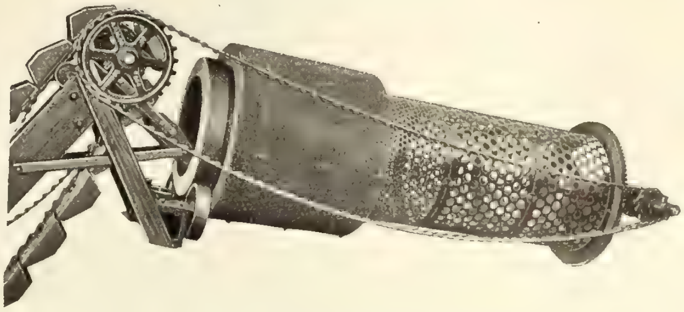
Street Sprinklers,
Sweepers and
Cleaners

Parts for Various
Makes of
Road Machinery



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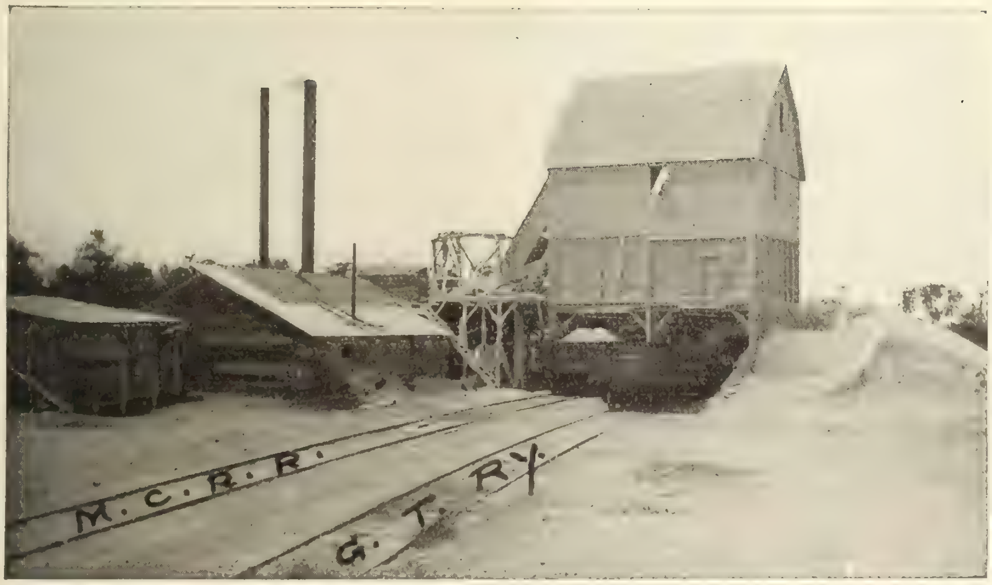

must be built of a

Tough Stone

that will cement

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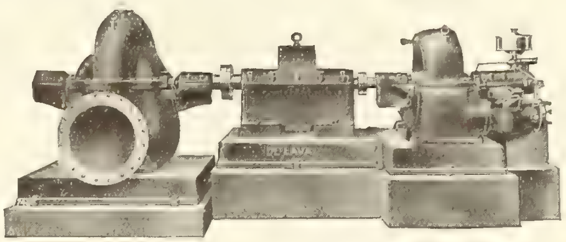

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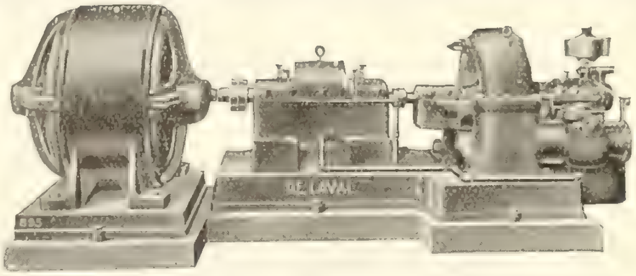

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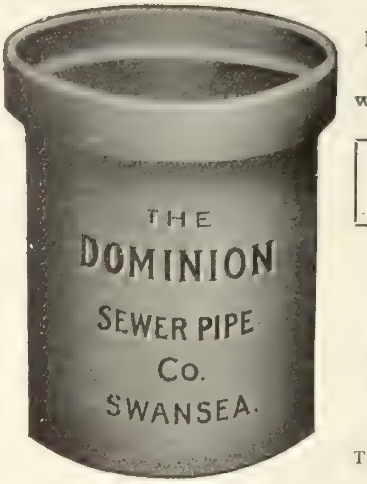

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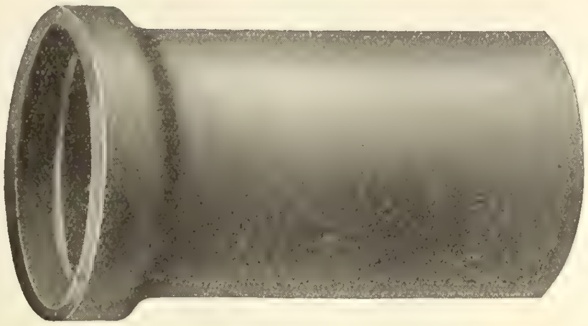

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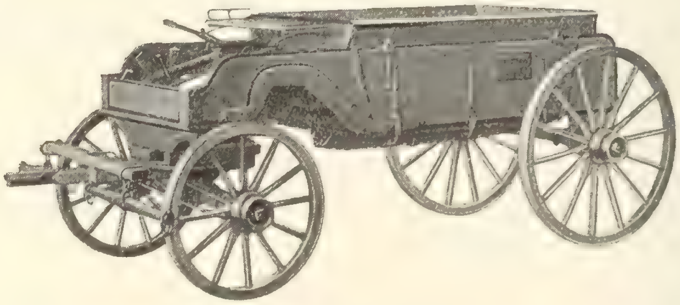

The lure of the "just-as-good" is very strong. It has cost some contractors quite a bunch of money. It sounds reasonable. The only trouble is—it does'nt work.

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IN every building where fire doors of any type are essential, the most satisfactory to specify is the

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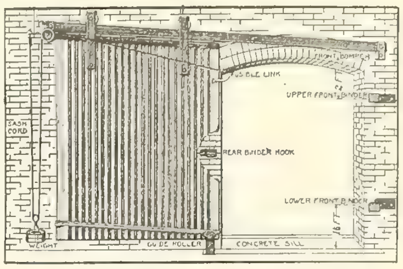

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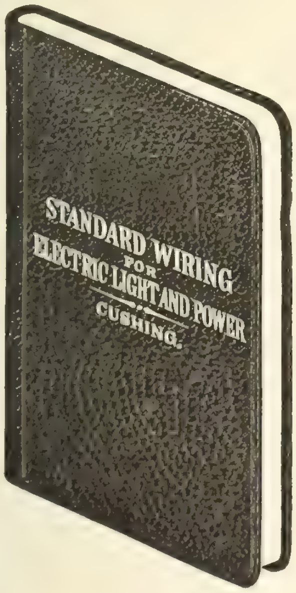

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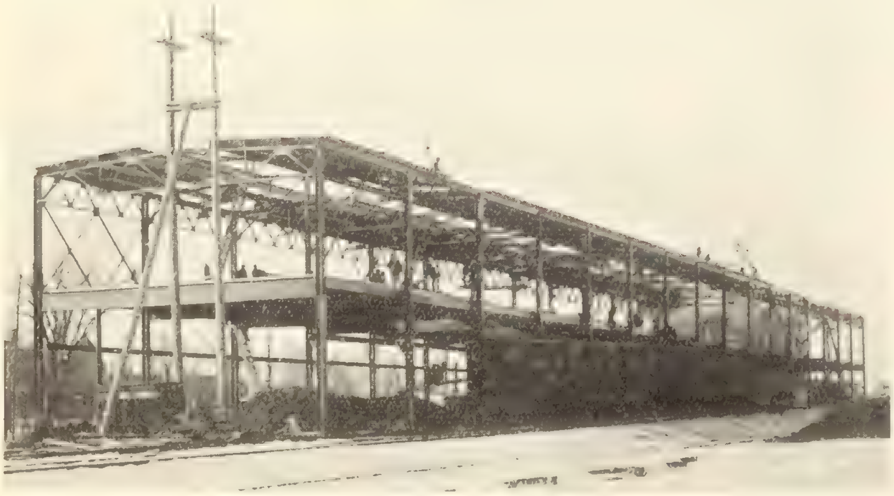

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A Ripe Example of Architectural Inefficiency

IN an article dealing with architectural inefficiency, published in our issue of January 20th last, we classified the members of the profession in three types, of which efficiency was represented by the figure of 17 per cent. In support of our arguments we referred to a number of legal decisions against architects—typical cases in which the profession had exhibited negligence and other unbusinesslike and inefficient traits.

Our article gave rise to considerable discussion. The Building News, of London (Eng.), treated the matter at some length in a leading editorial article, while Mr. R. M. Fripp, F.S.A., of Vancouver (President of the Architectural Institute of British Columbia), took up the cudgels on behalf of the profession in our issue of March 17. The case for the defence was presented in a very able manner by Mr. Fripp, but it collapses under the weight of the evidence of those who have had "unfortunate experiences" the possibility of which Mr. Fripp himself admitted.

In the way of a specific instance of an "unfortunate experience" it may be of interest to tell of what happened to a man who engaged a leading architectural firm to prepare plans for an hotel building, costing, complete in all departments, not more than $500,000. (Before it was actually completed and ready for occupation it cost $1,250,000!!) The owner had confidence in the standing of the firm, and at the outset he followed their recommendations implicitly—with the result that construction work was started before the complete plans and specifications were delivered and before bids were secured on the whole installation. The result was that he was at the mercy of these gentlemen, as the subsequent installation necessarily had to conform to the shell of the building. When the plans were submitted they were incomplete in every way. The most common details of hotel planning were omitted, and one of many blunders consisted of duplicating plumbing and water supply pipes for adjoining tiers of bathrooms. After endless trouble and worry the building had to be re-designed and reconstructed, resulting in extras of some $100,000.

In this case the owner attributed his "unfortunate experience" not so much to the wilful indifference of the architects as to their ignorance of the requirements of a modern hotel and their inability or unwillingness to learn them. Apparently the members of the firm were uninformed on some of the most elementary requirements of design and construction.

As a result of his experience the hotel man is of the opinion that the average architect is wholly unfit to be entrusted with the details of a large building project:—"He is bound by precedent to such an extent that he lacks receptivity; he is not in sympathy with new ideas or new designs; and he looks with hostility on any suggestion that may be a departure from the beaten path to which he has been accustomed."

There would appear to be much truth in the contention that the average architect who has been in business for a number of years and has got on fairly well in the way of accumulating money acquires an exaggerated idea of his ability and importance. This is true in Canada. The architectural profession in this country may be said to be in its infancy: it has yet to make its history. Albeit, some of the leading members of the profession are harder to see than a Cabinet Minister. Their time is reserved exclusively for clients. Within the sacred precincts of their office never has the foot of a supply traveller or other such inferior specimen of humanity yet trod. They imagine all sorts of highly exaggerated things about their professional status, and they attribute to themselves a combination of excellent qualities while possessing none of them. As for what they know, they are informed in every branch of building and contracting! Expert advice with them is quite superfluous. They claim to be able to design and erect any sort of a building, regardless of its technical character, and they will actually undertake it without seeking advice from specialists. Instances where this has been done and carried to a ludicrous extent are numerous.

Too often the architect is lacking in the most elementary knowledge, and it is only after the building operations are complete and expensive mistakes have been made that the owner or builder starts thinking about architectural inefficiency.

"Unfortunate experiences" with architects! How many times have we not heard of ridiculous mistakes in estimating the cost of new buildings? The architect is assumed to know something of prices and the ultimate cost of building construction, but we are in agreement with the gentleman whose experience we have cited above, that "one may take the average man of affairs and secure from him a more accurate estimate of costs than one can get from the average architect."

Much more might be said about "unfortunate experiences," but the other phases of the subject will provide food for later discussion, perhaps.

Advance Planning Cheapens Construction

COSTS can be cut by planning in the home office or the construction office the details usually left to workmen and foremen. In a paper presented recently before the Western Society of Engineers by Sanford E. Thompson and William O. Lichtner it is shown that one firm engaged in reinforced-concrete building work cut costs on form work alone by the use of these methods from 7¾ cents to 5½ cents per square foot. The methods outlined have been applied with equally striking results to several classes of construction.

According to this method, such planning includes not merely laying out the installation of heavy machinery, the successive moves of derricks, etc., but also planning the delivery of material and all the different moves to be made by individual gangs from the start to the finish of the job.

Sequence of Work Studied

First, the entire job, including all temporary as well as permanent structures, is studied from beginning to end, and detailed plans of everything to be made on that job are worked out. Next, the sequence of the job is planned from beginning to end, and every construction operation, down to the successive erections of temporary platforms, planned. Then a purchasing schedule of every item that will be used is made, and transferred to material slips showing what is needed, when it must be ordered, and to what spot on the work it must be delivered. A schedule is made showing the number of men and foremen of each trade required from start to finish to accomplish the work as it is laid out on the progress schedule. So far as possible (and the farther it is carried the better it pays) the amount of work to be done by each gang, and even each man, is reasonably laid out for each day, and cash bonuses are provided for exceeding the estimated day's work. Finally, the superintendent and the force at the job must see that materials arrive as called for on the schedule; that the proper number of men are provided; that work starts at each particular part of construction on the proper date; and that each foreman and man understands in advance exactly what he is to do and how he is to do it.

There rests with the superintendent and his force the task of training the foremen and workmen in the most efficient methods of going at their work. If the men's moves are planned in advance in this way, and the right materials and tools delivered to them at the proper place and time, and cash inducements offered them to develop their efficiency and exceed their schedule, the work will be in no danger of lagging behind the desired progress.

This plan, of course, requires that the designing force be in much closer touch with the construction force than is the case with most contracting firms. The planners, of whom the superintendent should be one, must be men with engineering knowledge, but also men who know construction work thoroughly and who are capable of laying out schedules without any of the absurdities so often found in such plans.

Made in Canada

THE "Made-in-Canada" idea is a curious anomaly, in that it combines the best and the worst business principle—the best in the idea of having Canadian goods occupy a position of pre-eminence by virtue of quality and value, and the worst in that of using the cloak of patriotism to cover the foisting of inferior goods at a higher price.

In theory there is much to commend the "Made-in-Canada" movement; in practice there is much to restrict it. If we are going to promote it successfully we must put reputation first and dollars last; we must make "Made in Canada" synonymous with "Made RIGHT in Canada."

Quite recently we heard of a large restaurant owner who wanted a couple of hundred bentwood chairs bearing the "Made-in-Canada" label. He had to pay the same price for the Canadian chair as for the Austrian chair, and he got a distinctly inferior article: he paid 25 or 30 per cent. for his "patriotism."

Not long since a well-known United States advertising journal conducted a careful inquiry into the wisdom of fostering the "Made-in-U.S.A." idea, and the expression of opinion contributed by the heads of some of the largest concerns in the United States was distinctly unfavorable. Perhaps the best sentiment is expressed by one of the contributors in the following extract: "Of course I am a believer in American goods; but an ounce of doing is worth a ton of preaching. When our manufacturers have produced things that are a little better than similar things produced elsewhere you may be sure that the people of this country will buy them."

Pre-eminence in competition is the only sure foundation of success. Essay to build up the business of the country under the protection of a high tariff wall, if you will; allow your manufacturers to combine and put up their prices, the while delivering inferior goods—and your whole structure will crumble and decay.

There is no use in our running wild on the "Made-in-Canada" slogan. Neither as manufacturers nor as consumers will it pay us to isolate ourselves from the outside world. The benefit would accrue only to the select few. Canada first and Canada last—but VALUE FOR VALUE, AND COMPETITION ALWAYS, if we are to remain a factor worth considering in the industrial world.

Self-Election

THE ablest leaders are self-chosen, comments Engineering and Contracting, editorially. This is true industrially as it is true politically. When the civil war began, many volunteer companies and regiments elected their own officers. The choice commonly fell upon the men who looked or talked the military part. However, a few months of actual service under gun fire effected radical changes. Then brave and resourceful men in the ranks proceeded to make themselves leaders. The iron soldier pushed the tin soldier aside. Every war repeats such history.

In politics we see much the same phenomenon, but there it is obscured by the fact that the real political leaders often remain hidden from the public eye. From the adviser who dominates a king to the ward boss who controls a city council, it is the self-chosen man who often rules. Unfortunately political rule of this sort is apt to be bad, because secret control is conducive to selfish and dishonest action.

In the industrial world, co-operative production, under chosen managers, has usually proved inefficient. The workmen who chose a manager of a co-operative factory either select a "good fellow" type of man or one who talks plausibly. In either case the chance of selecting wisely is not great.

In every walk of life the really capable leader nominates and elects himself. The soldier, by virtue of his own fighting force, seizes the epaulettes. The industrial worker, ignoring the opinions of his mates, sets up in business for himself—elects himself a sergeant in the industrial army. It is true that thousands thus self-elected fail to maintain their positions. Their courage or their self-esteem often exceeds their ability. But, none the less, by this process of self-election do the fittest business managers emerge from the crowd.

The training of engineers, coupled with their ethical codes forbidding self-advertising except in the mildest manner, has not been favorable to their pushing themselves into managerial positions. In spite of these handicaps, however, engineers, here and there, have decided that they were more fit to manage affairs than were the existing occupants of certain managerial positions. Accordingly, they have not waited to be "urged to run," but have set about making themselves executives. Thus it has come about that most of the "city managers" in the two dozen cities that have adopted the new form of government are engineers.

Only in a restricted sense it is true that "all things come to him who waits." All that a waiter commonly gets is tips—the pecuniary crumbs from the rich man's table. Much truer is it that all things come to him who nominates himself, and, ballot after ballot, casts a unanimous vote for his nominee.

Balance in Design

EQUAL disposition of mass about a centre or axis is due to a law having its origin in the demands of equilibrium. In architecture the rule applies rigidly to free-standing parts and components, such as columns. It cannot always, and need never, of necessity, apply to a whole composition. No doubt a peculiar dignity, not obtainable otherwise, attends the exactly-balanced facade in monumental buildings; but site, circumstances, and practical conditions often make it an impossibility for the designer to proceed on centre-and-wings principle. We have, then, to design irregular building masses with grace and beauty. Irregular architectural composition favours variation and novelty: that which at first sight seems an evil need not necessarily prove so. Looking back into architectural history, we see that irregular plans are by no means inconsistent with grandeur of effect. The departure from exact balance in Gothic buildings gave them one of their greatest charms.

In all styles the rule of exact symmetry in the part is closely followed. This assertion may seem inconsistent with fact, and would be so did we not here include all components that are wanting in exact equal-sidedness by reason of their breaking into other masses. Where a square plan breaks into a circular, the square and the circle are broken; but the spirit and intention in the square and in the circular plan is exact symmetry. When, therefore, we assert that in all great architectural styles the law of equal disposition of mass about a centre or plane is duly honoured, we include, for the reason stated, symmetrical components breaking into others. It is possible that those of expansive views, but small practical experience, in architectural design would regard part breaking into part, and leaving an irregular junction, as fatal to all beauty of effect. The architect will contend that such irregular junction, whereby something on asymmetric principles is produced by the union of two symmetrical objects, is not only without offence, but may originate great beauty and interest, and is quite an essential in the "picturesque." If we generally agree upon this, then something is gained of practical usefulness to the asymmetrical planner, and to all whose minds are greatly exercised with questions of "balance" whenever they are compelled to abandon the principle of centre-and-wings.

The stair-turret and the tower are largely evidenced in our old village churches. We have shown that both the turret and the tower are planned, in spirit, as objects of geometrical regularity and exact symmetry (so called). As carried out, an irregular, unbalanced mass is produced. To destroy symmetrical orderliness by breaking the one into the other seems, at first, a crude idea, likely to cause offence; but we have urged, and taken for granted the concurrence of the reader in our view, that no such offence is produced, but that, on the contrary, a resultant architectural mass of true beauty and interest is obtained.

Under certain conditions, an element or compound will crystallize in true "symmetry" as a cubical figure.

a tetrahedron, or the like. Under other conditions the crystals cluster. The freeborn, regular, isolated crystal is an object of beauty; but no less beautiful or interesting is the group of associated crystals. Yet here, as with our turret and tower, and as in the case of all irregular junctions of divergent masses in building, broken and diverse—asymmetric—forms are produced; but so much of each crystal as exhibits itself is true to the crystal form, true to angle of crystallization, and possessed of symmetry. On the face of things, one might conclude that the irregular massing of crystals would destroy their beauty. All who carefully ponder this matter will admit, we think, that the resultant forms, lines, outlines, and masses are beautiful, often very beautiful indeed, and highly suggestive for the picturesque grouping of masses of building on the asymmetric system—that is, opposed to the centre-and-wings arrangement. We should consider this natural phenomenon, and endeavour to establish some general proposition respecting the breaking-in of part to part in architectural composition. On elevation, such masses may appear at times "lopsided"; but this effect of out-of-balance disappears in perspective.

The laws of exact symmetrical, or equal-sided, composition having become of none effect by our abandonment of the centre-and-wings principle, on account of site or questions of practical service, we no doubt are often tempted to endeavour to restore a quasi-balance by some suitable manipulation of the masses. We believe this anxiety to be born of a misapprehension. As we have suggested, that which in elevation strikes the eye as out-of-balance and wanting redress may not appear to have such defect in actual building. Rochester Castle has an asymmetrical addition. Fond of exact symmetry, this might not please on an elevation. It is doubtful if any, on pure aesthetic grounds, would desire to remove the addition; it might be more than suspected that its removal, while certainly leaving a symmetrical keep, would leave us with a grievance and regrets.

Once we have, either by choice or necessity, abandoned the centre-and-wing plan, we must, we assume, proceed on a different fundamental design principle. Asymmetrical or irregular composition must be adopted without compromise. There must be no weak leaning towards the rules of symmetry, and we should ascertain what will be the true effect of masses in execution before we amend apparent defect on elevation. Equal-side, centre-and-wing composition of a whole facade is one way; the other is totally different. It was, some time back, observed to us, on passing a block of office buildings, that it seemed that the tower "should have been bigger." The observation was not made by an architect; but, all the same, it was much to the point. A strictly "symmetrical" facade, with equal mass right and left, up to about roof-line, had on one side a weak, half-hearted turren—an excrescence just budding, one might say. The effect and impression was that the designer had hesitated to destroy the exact equal-sidedness. Had a bold tower been provided, the composition, from a mere tribute to pseudo, or distorted, symmetry, would have passed clear into true asymmetry.

In a very difficult subject, we have endeavoured to suggest two rules for guidance in irregular architectural composition, such as we find must necessarily pertain in the great majority of buildings: firstly, to maintain the great principle of mathematical equal-sidedness in the part, either actually, as in a column, or in spirit and intention, as in the circular turret breaking into the square tower; and, secondly, that when once the symmetrical whole facade is not possible, or not desired, the asymmetric principle should be consistently obserevd. If we believe in the former suggested rule, we shall not put pilasters with one left-hand volute on the right side of a facade, with a right-hand, single-voluted cap on the left wing. In irregular architectural composition we must needs be too urgently concerned in rendering each part beautiful to have time to waste in perpetrating these or other monstrosities. The offence is against the rule of studied "symmetry" in the part. The strongest argument for irregular architecture, and for dispersed ornamental device, is that each part of the composition may be so fashioned as to be interesting and graceful, irrespective of other parts. In unbalanced (in a sense) composition we need not distort the unit for the sake of some whole effect; and a beautiful building, surely, should be such that, as we pass along, every part, contributory on the whole, should appear an object of interest and beauty. Then architecture bears comparison with music. Our subconsciousness, or memory, holds the general air and progress of rhythm and melody, while our immediate consciousness is enthralled with the instant harmony. We cannot have it both ways: either there must be symmetry, so-called, or asymmetry—either a St. Ouen interior or a west front of Rouen Cathedral.

The idea that we must "balance" in irregular architectural composition is often a delusion, an impression, a legacy of lingering sympathy with exact equal-sidedness, itself largely the outcome of habitual elevational display of architectural device. The lion is sufficiently like the unicorn to balance in heraldic composition; sufficiently unlike to give individual interest to dexter and sinister hands. If we duplicate either the real or the mythical quadruped, we certainly attain exact equal-sidedness; but sameness is substituted for variety. This, by the way, demonstrates the fundamental difference between asymmetry and symmetry, so-called. We cannot, however, deal with architectural mass as the herald employs lion and unicorn. Divergent "twin" towers to cathedral west-ends may have a certain quaintness; but we generally feel dissatisfied, or unconvinced. The failure may, perhaps, be accounted for as the result of an attempt to graft asymmetry on symmetry, which we have endeavoured to show is not possible. We must either produce the monumental, equal-sided building, or start away on a new plan, based on quite a different principle. Small variations in detail are added charms in many symmetrical compositions; but a great belfry is not a detail.—The Building News.

A coat of high-temperature extra-heavy stack paint applied to the brick boiler settings in the plant of the Springfield (Ohio) Light, Heat and Power Company increased the natural draught through each furnace by 0.15 in. The manager of the company conceived the idea of experimenting with paint on the boiler settings, and it was under his direction that the first trials of this draught-increasing idea were made at Springfield. Two men were placed at work on the side of a setting, and even as they worked it is said that an observer at the draught gauge could detect the upward trend of the water column. When the painting of one setting had been finished, the workmen began on another, and as the pores of the brick setting of each unit in the boiler-room were sealed with paint approximately the same increase in draught reading was noted.

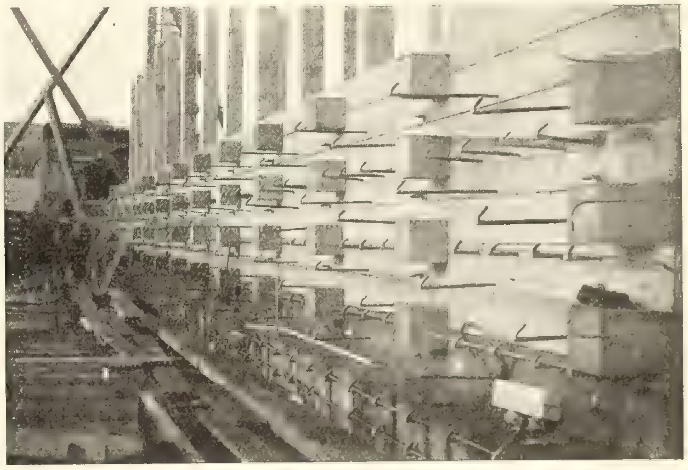
Crib, ready for launching.

The New Government Dock on Burrard Inlet, Vancouver

THE accompanying views are of the construction—now in progress—of the new Government dry dock and grain elevator on Burrard Inlet, Vancouver. The estimated cost of the two structures is $2,500,000. The new dock is being built in anticipation of the increased shipping business which Vancouver will receive as a result of the completion of the Panama Canal. When completed the dock will be one of the finest on the Pacific coast. It will be the largest of the Vancouver docks, and it will provide all accommodation, including railway tracks and warehouses.

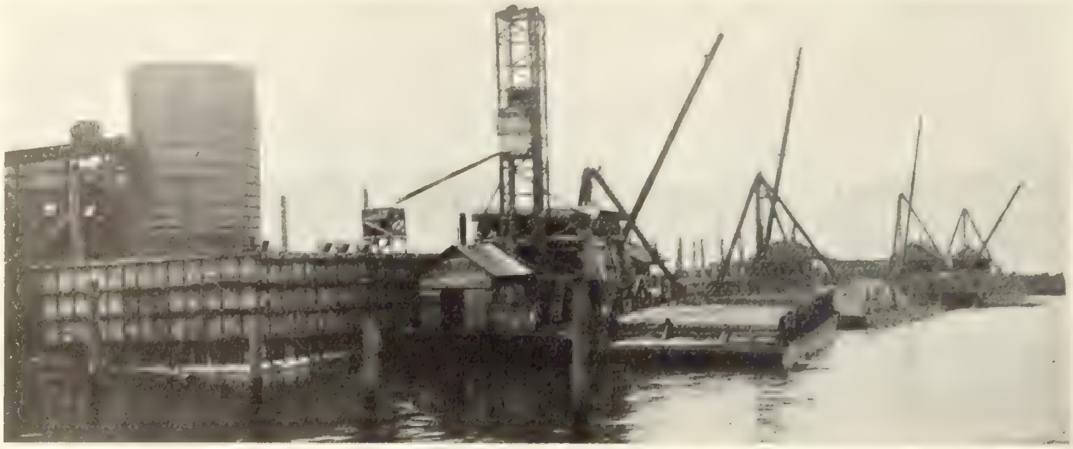
The contractors, Messrs. Henry, McFee & McDonald, commenced operations on April 1, 1914, and they expect to have the dock completed by midsummer, when the erection of the elevator will be proceeded with. The contractors for the latter work are Messrs. Barnett & McQueen, Fort William.

The structure will be 800 feet long and 300 feet wide, with slips on the east and west sides 130 feet wide. The depth of water in the slips and at the face of dock will be 36 feet at low tide. It was necessary for the contractors to put in equipment costing some $130,000 in order to handle the work advantageously, the drill scow alone costing $58,000. Nearly 120 ft. in length, it carried twelve separate engines and five drills, with their steel towers. The drills were moved along on tracks, thus permitting a line of seventeen holes to be bored into the rock at regular intervals without the scow having to be shifted. Dynamite cartridges were forced into the holes through tubes, and generally a whole line of charges were exploded at once. The broken rock was removed by the Pacific



Anchor bolts on crib for holding reinforcing rods.

Crib in position, partly submerged.



Giant Mixer, with travelling bunkers. Capacity, 40 cubic feet a batch.

Dredging Company's big clam-shell dredge, the material being loaded on barges and dumped in deep water. As the drill scow had to cover the area twice in order to reach the depth desired, some idea may be gained of the enormous quantity of rock that had to be removed in order to prepare the foundation for 23 huge timber and concrete caissons which will comprise the substructure. These cribs are approximately 88 x 40 ft. with a depth of 39 ft. They are built of 12 x 12 in. timbers, the bottom layer of each being 12 x 18 in. Cemented and made watertight, the cribs were floated into position and sunk, the filling required for each one being about 4,000 yards of sand and gravel. Nearly all the cribs are now in place, and work is being rushed on the superstructure and the huge concrete sea-wall which will enclose the entire dock. This wall is of solid concrete, 14 ft. wide and 40 ft. in height, the foundation being on solid rock.

The dock will contain 11,000,000 feet of timber, 900 tons of steel, 30,000 yards of concrete and nearly 100,000 yards of sand and gravel fill. In addition, about 500,000 feet of fill material will have to be placed after completion to level up the dock surface and approaches. Spur tracks from the C. P. R. will run into the dock warehouses and alongside the elevator and slips, thus facilitating the economical and speedy handling of cargoes and parcel shipments.

Seven derricks have been in constant use handling the timbers and other material; three of these are on shore and dock, the others being stationed off-shore to handle the fill material from scows and also the concrete coming from the huge mixer, which has a capacity of 40 cubic feet and carries its own bunkers.

The first crib was sunk in place January 18th, on the west side of the dock, the others following at the rate of one about every nine days. The filling to the required level occupied about three days more.

Painting Structural Iron Work

By A. Ashmun Kelly

FORMERLY, and even yet, to a large extent, it has been the practice to give structural steel a coat of some alleged protective paint, although many architects and building engineers prefer having the metal delivered uncoated. There is much to say in favor of this latter plan. First, the exposure for a time to the weather frees it from much of its loose scale. Then the painting done at the mill is usually done by unskilled labor, and therefore the paint is not applied properly, and the uncleaned metal is covered up so that it cannot be inspected. It need not be said here that the metal must be made perfectly clean before any coating is applied. The prime coat should be applied just before assembling the parts.

Rust and scale must be removed. Rust will continue even under paint, so that it must be removed. If the metal is allowed to stand exposed to the weather too long it is apt to rust, and for this reason it should be painted before assembling the parts. Then the painting can be done under the supervision of the architect or other person on the work and having supervision. And it is important that the paint be applied while the metal is dry, and, if possible, when the metal is not too cold.

The coating should be heavy rather than light, because, in general terms, the measure of protection afforded by a paint is proportional to its thickness, granting that the film is hard, elastic and adhesive. And there should be harder brushing in of the paint than on any other surface, because of the non-porous character of metal, this rubbing is causing the paint to adhere better.

The reason for having a thick paint film is that it will keep out moisture better than a thinner coat, and the more pigment the better the protection; linseed oil not being moisture-proof. Linseed oil alone when applied to metal affords almost no protection at all; yet when red lead is mixed with it we get a paint that is nearly ideal. Such paint is hard, yet elastic, thick, and very adhesive. It is possible to mix as much as 33 pounds of dry red lead to a gallon of oil and get a good paint—one containing the maximum of pigment. In fact, it is the paint for iron or steel work of all kinds. It is an inhibitor of rust, and is so dense a coating that water will not penetrate it, though it will any ordinary oil and white lead paint. Naval vessels are coated with it, and the mammoth steel members, as well as all minor members, of the Panama Canal are coated with it; in fact, practically all structural steel is coated with it. Engineers and chemists agree that at least two coats of red lead paint should be applied first, after which any purely decorative paint may be given.

When painting metal work it is a good plan to make each red lead coat a little different in shade, by adding some lamp-black to one coat. In this way the inspector can detect any faulty work. The lamp-black will not do any harm, but is rather a valuable addition to the paint.

In preparing the metal for painting the surface must be freed from scale, moisture, grease and rust. This can be done with benzine for washing off grease, and with steel wire brushes for removing mill scale. Any holes, large or minute, should be filled with a proper putty before painting. Be careful to paint all parts, for if the metal is allowed to touch, face to face, rust will follow; local galvanic action is excited, causing the corrosion.

When it is necessary to repaint structural steel work the work should never be done in winter, or in wet weather. Take as dry and warm a time as you can. The cleaning off of the metal must be very thorough, removing all rust or scaly paint, etc. All rusty parts, or where the paint has come off, should be made clean and given a coat of red lead paint, after which the entire surface may be painted with any desired paint. For repainting such surfaces we would advise the addition to the paint, made with raw oil as the chief thinner, of a little benzol or turpentine. This is for the first coat only; though turpentine in a small amount will do no harm on any coat, except that it is apt to dull an oil finish if in excess, though it will make a paint much harder. Benzol, being a solvent of oil, is not advised on any but the priming coat.

Another very good pigment for iron or steel work is iron oxide, though the red lead paint is the very best for contact with the metal, after which the iron paint may be applied, if its color is not objectionable, and this may be modified with lamp-black. Oxides do well in paint subject to much exposure; hence iron oxide and lead oxide (red lead) are good pigments. Zinc white is an oxide—true—and a very desirable pigment or base, but it is too hard, is non-elastic, and therefore does well only in connection with another pigment having more elasticity, such as white lead.

Red lead paint should be mixed and used the same day, as it oxidizes so readily that as a paint it soon forms a cement; besides which it settles in the pot—though there are some red leads that do not settle very much, if at all. Mix with raw linseed oil, the following being a typical formula: To 100 pounds dry red lead add, for summer painting, 4 gallons raw oil, and for winter painting use boiled oil; add also in either case 1 gallon turpentine, and ½ gallon japan driers for the raw oil, none for the boiled oil. By adding 10 ounces dry lamp-black to the 12 pounds of dry red lead, with oil to make a gallon of paint, you will get a colored red lead paint as previously mentioned.—By Ashmun Kelly in The National Builder.

In the construction of their colonial railways, states the Railway Age Gazette, the Germans apparently were not unmindful of their defence. Their greatest system, the Dar-es-Salaam-Tanganyika Railway, commonly called simply the Tanganyika Railway, was completed last year, and is approximately 780 miles long. At Tabora, 530 miles inland from Dar-es-Salaam, where many great trade routes converge, the Germans constructed a massive modern fortress. The great value of the railway as an economic factor lies in the fact that it borders on three great inland seas—Nyassa, Tanganyika, and Victoria Nyanza—thus linking up the trading centres, the great lake system of Central Africa, and the river Congo with the east coast ports.

Hydration of Portland Cement[*]

SOME useful results obtained by the United States Bureau of Standards have lately been made public in a paper by Messrs. A. A. Klein and A. J. Phillips, describing various hydration experiments on calcium aluminates, calcium silicates, lime burned at different temperatures, and high silica, low silica, high iron, and high magnesia Portland cements. The subjoined notes refer only to the experiments on the last mentioned class of products.

On the hydration of cement, the first constituent to react is the aluminate, with the formation of amorphous hydrated tri-calcium aluminate, with or without amorphous hydrated alumina. Sulpho-aluminate crystals are also formed, and the low-burned or finely-ground calcium hydrates. This occurs within a few hours after the cement is gauged. The next compound to hydrate is the tri-calcium silicate. This commences within 24 hours, and is generally completely hydrated within 7 days. Between 7 and 28 days, the amorphous aluminate commences to crystallise and the beta-ortho-silicate, the least reactive compound, begins to hydrate. The 24-hour strengths are due mainly to the hydration of the aluminates and of any fine-grained, low-burned lime present. The large increase in strength between 24 hours and 7 days is due mainly to the tri-calcium silicate hydration. The increase between 7 and 28 days is due to the hydration of the beta-ortho-silicate. Where there is a decrease in strength during this period it is due to the hydration of very high-burned free lime, as in very high-burned, high-limed cements, or to the crystallization of the aluminates, as in high alumina cements. The iron compounds in a cement are resistive to hydration, and the iron does not form crystalline hydration products, but occurs as a rust-like material.

The initial set of cement is affected by the action of small amounts of electrolytes in retarding coagulation of the aluminate material. With a limited amount of water, as in normal consistency mixtures, the aluminates coagulate and separate from supersaturated solutions as amorphous bodies, the rate of coagulation being affected by such small quantities of electrolyte as to nullify the possibility of the reaction being a purely chemical one.

Failure of cement in accelerated tests is due to the growth of large calcium hydrate crystals. The disrupting action of these results from the pressure caused by growing crystals. Cement will fail in the boiling test which contains lime sufficiently fine and high burned, so that during boiling it will hydrate and crystallize. When a cement passes the boiling test but not the autoclave test, it contains lime so coarse or high burned as not to hydrate in the boiling test, but only in autoclave, owing to the high temperatpre and pressure employed. Some cements will pass either test only after ageing. In this case, aeration with sufficient water to allow solution and crystallization causes the lime to hydrate as amorphous hydrate, and in the accelerated tests there is no crystallization and no disintegration.

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[*] From a report of the U.S. Bureau of Standards.

Concrete Failures:—An Analysis of Their Contributing Causes

By R. S. Greenman

CONCRETE is said to be its own best inspector, and it is a well-known fact that defects in concrete will sooner or later make their presence known. For every fault there must be a reason. The reasons for poor concrete have been proportioned as being 90 per cent. due to poor workmanship, 8 per cent. due to poor aggregates, and 2 per cent. to poor cement. These percentages are not the result of tabulations, but are those prevailing in the minds of many who have had considerable opportunity for inspection of concrete, both good and bad. But whether or not these percentages are correct, the statement raises the question: "What are the reasons for poor concrete and how do we determine these reasons?" It is a certainty that neither a laboratory test nor a field inspection alone will give them, unless, of course, it be a simple failure. Yet there are people who will examine a piece of concrete in the laboratory and offer a solution of the problem simply by tests made there. And, again, an inspector will look over a piece of concrete construction, and, with no knowledge whatever of the characteristics of the materials used, nor of the method of making, will attempt to tell how such and such a condition developed. Concrete failures can be explained only after thorough investigation by men who know good or bad concrete from long and close acquaintance, and whose minds are of an analytical and judicial temperament. The more one sees of concrete, the more one becomes convinced that it is the most abused structural material being used. The science of making concrete has been looked upon too generally as being very easily learned, with the natural result that a great deal of poor concrete has been made. Now, however, builders, contractors, and engineers apparently desire to make concrete that will meet the standard in quality required of other materials; and yet, with all the precautions now being taken, there is still a large amount of concrete that is not satisfactory. The larger the work, the greater the care taken; and, vice-versa, the smaller the work, the greater the carelessness, and the greater is the ratio of the failures, and it is the sum total of these failures that makes the loss caused by poor concrete so great. In trying to solve a problem of poor concrete, the elements to be investigated are the three already mentioned—cement, aggregates, and workmanship—and water. The common tendency is first to place the blame upon the cement; but if we find that in accordance with good and generally common practice, the cement has been tested and has met the standard requirements, the cement then becomes a negligible factor; but if it has not been tested, it must be considered as a possible cause, and it may become a large item in the study. We must admit that since so much stress has been laid upon the value of having cement tested before use, and since it must indeed be a small work where it has not been so tested, the percentage of failures due to poor cement has been reduced to a very small amount. If the next element had been given equally as thoughtful consideration to its use, there could not be so much poor concrete due to poor aggregates. The strong and weak points in both the coarse and fine aggregates have been too often neglected. The coarse aggregates can usually be judged by easy inspections, but sand or other fine aggregates need very careful examination. The characteristics of sand—such as the grain, the grading, the cleanness, and its freedom from organic impurities and excess of loam—are items of knowledge which are obtainable mainly in the laboratory, but which are very essential for the correct diagnosis of a concrete failure. The effect of workmanship is by far the largest factor, and in it all others are included, for a poor workman can destroy the value of the best materials. Under the head of workmanship must be considered such items as design, proportions, placing, and actions resulting from heat, frost, electrolysis, etc., which should have been taken care of during the process of making and preservation.

As another element of importance, it must always be kept in mind that the water used in making the concrete, or which may come in contact with it, may prove to be a very influential factor for harmful results. Then, if one is given a concrete failure to diagnose, one must look for a reason under cement, aggregate, workmanship, and water. As stated, the easiest explanation is to look for some fault in the cement; but if, as has been suggested, the cement has passed the usual tests, then other reasons must be found. To find them requires that the investigator shall first know conditions and causes of failures; but these will not be further discussed except to point out the way to the reason; then the investigator must attack the problem with an open mind—that is, he must not jump at a conclusion and expect to be able to work out an explanation around that conclusion. Then it is even more essential that the investigator shall have had an opportunity to learn the results of tests, or to make tests that will enable him to judge the probable actions from the characteristics of the aggregates. Also a very careful examination of the concrete in place is generally an absolute necessity. To attempt to outline a plan for procedure in this examination would be folly, since each individual case has conditions that are decidedly its own, and the law of probabilities makes possible many combinations of causes which can be worked out only as one would solve any involved research problem. Clues must be sought, and a sharp eye, a quick ear, and a questioning tongue must be alert to grasp a clue and pursue it to a definite ending. If anyone should be sceptical of the efficiency of this method, it is possible that a few illustrative cases, selected from a large number of diagnoses, may convince that one that the method has proven, and can prove, successful, far more than is generally expected.

Failure Due to Water

A highway was being built, and the plans called for several new concrete culverts. All but one of these culverts "set up," or hardened, nicely. This one did not; and yet the same cement, sand, and stone had been used as in all other culverts. A reason for the failure of the one culvert was desired. It was found that the brook which flowed through this particular culvert passed in its course the plant of a company engaged in

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*Abstract of a paper read before The American Society for Testing Materials.

the manufacture of medicine from herbs. The refuse from the plant so loaded the water with organic matter that it prevented a proper hardening of the concrete. No one connected with the construction of the culvert knew that water so contaminated would have that effect, and the complaint came in that the cement was not acting properly. The brook was temporarily diverted, other water was used, and the concrete acted normally. A condition had existed there which would not have existed in city water, but which is found frequently in the country, especially in wooded sections. To detect the cause, one had to know that certain elements, such as tannic acid, alkalis, salts, etc., foreign to most waters, do affect concrete.

Failure Due To Sand

For an illustration of the effect of a poor quality of sand, consider the following case:—

A cry of alarm come in from an engineer that the concrete in an important bridge abutment had been in place for over two weeks, and that in attempting to remove the forms it was found that the concrete was still so soft that it could be cut out with a knife. A brand of cement new to the work had been used, and the blame was, of course, placed on it. An examination showed that a footing for the abutment had been made of the brand of cement first used on the work, and that, although ten days older, the concrete could easily be cut with a knife. The evidence eliminated the cement. Examination of the sand showed it to be well-graded sharp sand, but a clue was furnished by some yellow-coated grains. The investigator had already had considerable experience with similar sand grains. A trip to the sand-bank showed just what he expected to find. The bank had not been stripped of a top layer of yellow-coated sand, which gives a sand with which it is mixed a tendency to delay very materially the hardening of the concrete in which it is used. In time, usually several months, the concrete will harden, and there is ultimately no harmful effect apparent. Lack of knowledge of this particular quality has caused an investigator of another piece of work to tear it out and rebuild.

Failure Due To Stone

A very unusual condition existed in another case, but it emphasises strongly the need of following clues. A concrete wall was apparently disintegrating, due, as the engineers believed, to free lime in the cement. In various places on the face of this wall there appeared what can best be described as "blisters." By prying off these blisters, there were produced small cones about 6 ins. in diameter and 3 ins. in height; and in the apex of each could be seen a small, yellowish-white spot about the size of a small marble. The trouble was clearly not a case of free lime in the cement. One unusually large blister enabled the author to dig out from the apex a soft stone about 1½ ins. in size. This stone did indicate the presence of free lime, and, after a few weeks on the author's desk, slaked into a powder. Examination of the stone composing the coarse aggregate soon brought out the following:—

The crushed stone all came from the same quarry, but some came by a steam railroad and some by an electric railway. No concrete made by the former showed blisters. Concrete made from stone delivered by trolley did, but why? It seems that in the course of transportation by the trolley route the stone was conveyed in waste dump-cars, across the grounds of the company owning the quarry and conducting a plant in which limestone is an essential raw material. These dump-cars had not ben cleaned carefully, and to the good stone were added some small quantities of stone that had been through a chemical process and were on the verge of disintegration. In the concrete their expansive force blistered the face. By forbidding further deliveries by trolley the trouble was stopped. These may be considered extraordinary cases, but it is the out of the ordinary that makes trouble; if they were not the extraordinary, they would probably have been guarded against. They are, at least, typical of points for which one must look, if one would explain failures in concrete.

Failure Due To Workmanship

Failures due to poor workmanship are seen so often that, instead of citing particular cases, it will be sufficient to note briefly some causes or results. Failures from faulty design are shown in the mode of failure. The lack of proper proportioning may be clearly seen in a fractured surface; the grading of the aggregates is also similarly noted; and poor mixing and improperly placed concrete readily show themselves. All these are evident to an eye trained to know good or bad concrete. The failure to take care of laitance is made apparent by the seams that are bound to result from such a failure.

A concrete may be dense, but not sound and hard, and "sounding" with a hammer will show up this characteristic. Too wet a mixture with fine sand or silt or a crushed dust used as fine aggregate, may be a cause. It may be sound and hard, and yet be poor for certain uses because it is too porous. By scratching the face of unbroken concrete with a dull instrument, one may sometimes judge of proportions used, and, in its early stage, can also judge somewhat as to the rate of hardening. A pocket glass in the field, and a microscope in the laboratory, help materially in determining the density, and approximately the ratio of cement and fine aggregate to the coarse aggregates. The naked eye is all that is needed to observe concrete spoiled by sweepings of sawdust, shavings, or blocks, or by waste carelessly dropped into a form. Lack of protection to fresh concrete from the sun or unusual heat, may be noted by a "dried-out" and rapidly dusting surface; and from frost, by a flaked and scaly surface.

Influence of External Forces

When concrete has apparently been good for a considerable period, and has then begun to disintegrate, the reason for the failure must be sought in the character of disintegration, whether it may be due to changes in the elements or forces that have entered into it. If due to an internal influence alone, the fact will be noticed by the granular breaking up of the concrete. If due to an external force, such forces as sea-water, alkali salts, or electrolysis will be under the influence of any of them. For many years, all the failures of concrete were considered as being due to the formation of certain chemical reactions; but, as it is commonly acknowledged at present that an impermeable concrete will stand in sea-water as well as elsewhere, although subjected frequently to more severe actions than other concrete, its failures are due frequently to the same causes as those of other concrete, and therefore the same examinations should give the same results. Similarly, since electrolysis is considered as a cause for the breaking-down of concrete, the liability of concrete being affected by its influence will depend upon whether the concrete comes under the influence of an electric current. If it does, then its influence needs to be examined. If it does not, then the examination should also follow the usual method.

The value of laboratory tests and analyses should not be overlooked. While, perhaps, not giving as definite information as a field inspection, they should be used to the fullest extent to help establish the strength or weakness of a reasonable theory for the cause of failure. Where time will permit, laboratory tests of concrete made of the aggregates under as nearly as possible the same conditions, will give results that should aid in determining the fault in the original. Test specimens so made and treated should give practically the same results, and, when compared with test specimens made under ideal conditions or with standard materials, should give the investigator the reasons for the failure. All means possible should be used by an investigator in making his examination; and his conclusions must be drawn only after he has considered the failure from every probable cause with reason and fairness. The object of the examination is either to place responsibility or to guard against failures, and right conclusions are the only ones that should be drawn if justice to either object is to be given.

Detecting Underground Leaks

Methods Employed by Numerous Cities:—Isolating Distribution System Districts—By Sound at Valves, Services and Hydrants—Other Methods

UNDOUBTEDLY most, if not all, water-works distribution systems contain leaks of greater or less importance, by which amounts equalling in some cases thirty to fifty per cent. of the total amount entering the mains escapes underground. Various methods are employed in different cities for discovering the existence of such leaks and for locating them. Descriptions of such methods by several score of superintendents were secured recently by The Municipal Journal, and a summary of their replies is contained in the following paragraphs.

It is believed by some of those reporting that leaks (some claim all leaks) make themselves apparent on the surface, because of the sandy soil (the streets being unpaved). In other cities it is claimed that leaks show on the surface because the soil is clay. Still others state their confidence that leaks show on the surface, but do not state the kind of soil. The "pressure in the mains is high and drives the leakage to the surface" in two cities. In one town "Underground leaks show upon the surface unless the water finds its way to the sewer, in which case it probably is not discovered. As the per capita daily consumption is less than 50 gallons, this would seem to indicate that very little is lost in this way."

Where the distribution system is examined for leaks, perhaps the most common method is to isolate one small district after another by closing valves on all lines leading to it (this being done soon after midnight or whenever the large majority of the citizens retire) and determining whether any water would leave this district if water were admitted to it, by opening a valve slightly and listening for the "singing" of water entering through it; by installing a small pipe (say 1-inch) connection around one of the closed valves, a meter being inserted in the connection; or by carrying a fire hose from a hydrant in the isolated district to one outside it and under pressure, placing a meter on this hose line and thus feeding the isolated district through the meter. In any case the reliability of the test depends on all the closed valves being perfectly tight. To determine this, open a fire hydrant in the district before all the valves are closed and let it fill up. After all valves are closed, open the hydrant valve again; if the water flows out of the nozzle (or rises in the barrel), some of the valves are leaking—or else water is flowing back from some of the house plumbing into the mains, but the latter will diminish rapidly and finally cease, while the leakage would remain constant or even increase as dirt is washed out of the valve seat. It is possible that the leaks in the mains would continue to flow and balance some valve leakage; but as the open hydrant removes all pressure, this leakage probably would not be considerable. In addition to this, each valve should be tested by a water phone of some kind for leakage, whether the other methods are used or not. The return flow from houses could be prevented by closing all curb cocks before making the test, these cocks themselves having all been previously tested (on the previous night, preferably) by water phone.

This method of course tells only whether there is a leak or leaks in the district; its exact location must be determined in some other way; by subdividing this into smaller districts, if there are valves permitting of this; by driving a bar to contact with the main at intervals and listening with the water phone and looking for the appearance of water when the bar is withdrawn; by examination of sewers at all manholes (though flow in these may of course be natural ground water); or even by digging down to the mains at the low points in the district on the assumption that leakage water will follow the mains down hill, and "following up" any flow found there.

In Talladega, Ala., no systematic test for leaks is made, but when there is reason to believe that water is being lost in this way the distribution system is isolated by sections as described. A number of cities use the same method, listening at valves for leaks or determining them in ways not stated .

Maynard, Mass., Buffalo, N.Y., and Lancaster, Pa., use the method of connecting fire hydrants. West Orange, N.J., and Canisteo, N.Y., connect around a closed valve. Boston, Mass., uses a detector meter, which is a recording meter inserted in a line around a closed valve, as described. The same method, we understand, is used in Marietta, Ga., where one leak of 2,900 cubic feet in 24 hours was discovered, and several smaller ones.

Probably a number of other cities, which report using some variety of telephone receiver or microphone for detecting the noise of leaking, combine this with the isolated district method. The cities give the names of several appliances of this general character, such as aquaphone, sonoscope, waterphone, audiphone, etc.

Experience in several cities has appeared to indicate that considerable leakage may take place in the mains without being detected by aquaphone applied at the service.

In Pasadena, Cal., the total quantity of water delivered to one of the reservoirs is measured and is checked against the total quantity of water consumed from that reservoir as indicated by consumers' meters, and this shows a loss of 16.4 per cent. of the part of the total consumption delivered by this reservoir. Part of this, however, is used in flushing the mains, ditches and fire hydrants and in extinguishing fires, which amount is not metered.

In Mt. Carmel, Ill., when a leak is suspected along any particular line, an opening is dug down to the main. Leakage from the main always follows the pipe and will show at the hole and its direction from this opening may then be learned. Under a railroad crossing is always a bad place in soft earth on account of the vibration from trains.

Muscatine, Ia., makes routine examinations and finds about one-third of the consumption wasted. Frankfort, Ky., examines sewers for evidence of underground leakage. In Morgan City, La., pipes are about 2 feet underground and leaks are detected by sound or appearing at the surface. Winthrop, Mass., accounts for all pumpage except 21 per cent., in which is included water used for flushing sewers, sprinkling streets, building roads, filling skating ponds and extinguishing fires; the leakage is estimated therefore at about 10 per cent. Brookline, Mass., accounts by meters for all but 18 or 19 per cent. of the water pumped. Sedalia, Mo., examines sewers and laterals for evidence of leakage. Kalispell, Mont., uses test-holes over the pipe line. Livingston, Mont., tests by using pressure gauge—has found no leaks. Jamestown, N.Y., tests for the existence of leakage by shutting down pumps and noting drop in reservoir at night. Oneida, N.Y., uses needle bar for mains—has found no leaks in mains. Cincinnati, Ohio, considers leakage, if any, so distributed that cost of stopping would be greater than value of water saved. Duquesne and Ellwood City, Pa., use "an electric contrivance," but believe most all leaks of any size show up on the surface. Jeannette, Pa., has meter readers listening for sound—leakage usually found in poor joint on lead services or rusted galvanized service. West Newton, Pa., has found some of its biggest leaks by inspecting sewers from the manholes. In Clarksville, Tenn., service leaks from curb in are detected by meter (which is located at curb) or inspection. Pullman, Wash., has 13,000 feet of wood pipe and finds numerous leaks—has replaced 24,000 feet and 9,000 feet of steel pipe with Universal cast iron pipe in the last three years.

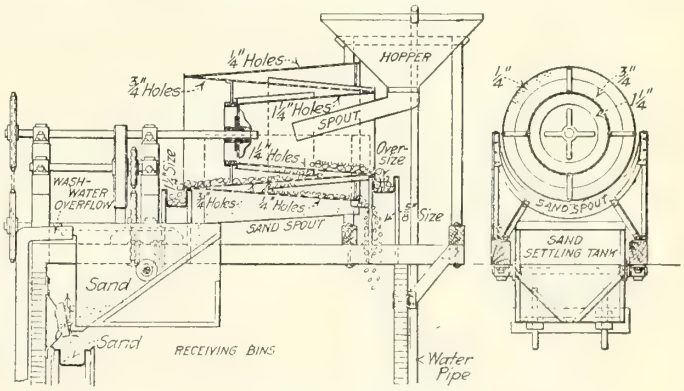
A number of cities have made, or periodically make, pitometer tests. The city of Winnipeg found 37 serious leaks, 201 medium, and 70 slight leaks in service pipes.

A paper read by Mr. M. McLaren before the American Association for the Advancement of Science deals with the use of electricity in the manufacture of Portland cement. The author says: "There are few industries in which the cost of power represents such a large percentage of the total cost of production as in the manufacture of Portland cement. Any means, therefore, which may be employed for reducing the amount or cost of this power must receive most careful consideration. A great deal of attention is being given to the development of more efficient methods of grinding, and while these efforts should be encouraged, the writer's experience indicates that the amount of power required to produce the same quality of cement varies little with the different types of grinding machines in common use, when given equally intelligent supervision. It is also believed that in no way can the cost of production be more materially reduced than by the extensive use of electric drive."

A Compact Screening Plant

A SPECIALLY compact plant for screening stone and gravel is made with telescoped revolving screens, so that three screens occupy the space ordinarily occupied by a single screen, while less shafting and a smaller structure are required. The screens are conical and are placed in opposite directions, all being connected to form one structure driven from one shaft. The construction is shown in the accompanying drawing.

The material is delivered by a spout to the interior of the smallest or inner screen, which has 1¼-in. holes, and the oversize of this falls out from the end into a spout or conveyor which returns it to the crusher. The material passing through this first screen falls upon a conical apron attached to the screen, which has ¾-in. holes. The 1¼-in. material passes out at the large end of this screen and is caught by a chute or conveyor. The finer material which passes through the perforations falls into a conical apron and is delivered to the upper end of the third and outer screen, which has ¼-in. holes.



A stone and gravel screening and washing plant with telescoped and concentric screens.

The ¾-in. material rolls out at the end of the screen, while the fine stuff which passes through the perforations falls into a trough or sand spout and goes to a settling tank or hopper. This hopper has an oscillating movement, causing the wet sand to flow out into another spout or conveyor.—Engineering News.

The method employed by the Niagara Falls Power Company for cooling its underground cables were described in a paper entitled "Effect of Moisture in the Earth on Temperature of Underground Cables," by Mr. L. E. Imlay. The scheme first employed was to circulate water through one of the vacant ducts adjacent to the occupied ducts. Later porous drain tiles were installed parallel to and above the cable ducts so that water flowing through the tile could percolate through the ground surrounding the cable and finally be carried away through agricultural tile drains below the ducts. The approximate temperatures of the cables were ascertained by inserting resistance thermometers in ducts adjacent to the cables which were supposed to be the source of heat. The temperature of the cable insulation next to the conductor was determined from these readings by referring to a chart based on a formula given by Messrs. Atkinson and Fisher in a paper presented before the American Institute of Electrical Engineers in 9913.

Care and Efficiency in Priming Dynamite

Increasing the Efficiency and Decreasing the Uncertainty of the Harmless Looking but Highly Potential Stick of Dynamite

MANY think that the priming of a dynamite cartridge is of very little importance—if the dynamite goes off, that is all there is to it. It is not widely known that the success or failure of a good many blasts depends on the position of the detonator—blasting cap or electric blasting cap—in the dynamite. Not only the amount of work done depends in a large measure on the priming, but also the safety of the loading operation is affected in many instances by the position that this detonator occupies. Many accidents have occurred and many men have been killed in loading holes with a primer made so that the detonator became jammed or wedged in the hole and exploded when the blaster endeavored to force it down.

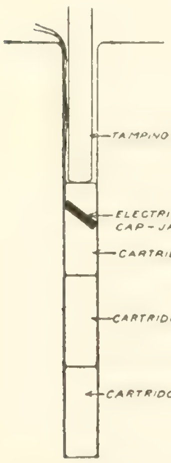


Fig. 1

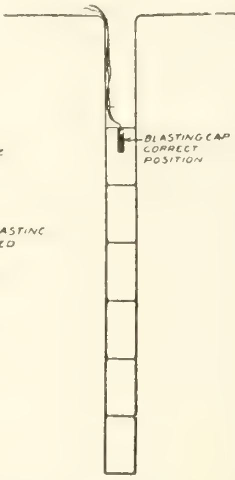


Fig. 2

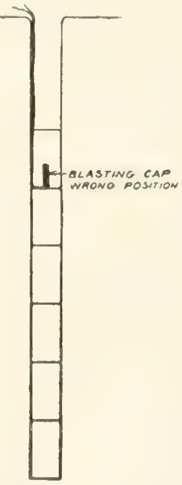


Fig. 2b

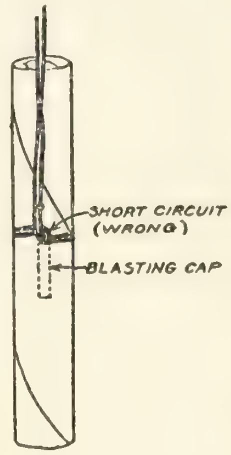


Fig. 3

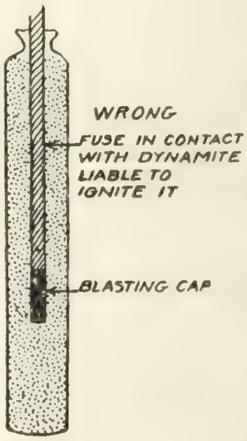


Fig. 4

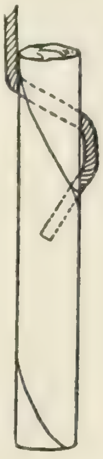


Fig. 5

The points to be borne in mind in making a primer are the following:

The detonator—and by detonator is meant either a blasting cap or electric blasting cap—must be in such a position that it cannot become jammed in the bore hole, as in Fig. 1.

The detonator must be in such a position that it will not be struck by the tamping stick.

The detonator must be fastened to the cartridge in such a way that when the wires or fuse are held in one hand by the blaster, and the cartridge seated with a tamping stick held in the other hand, the detonator will not pull out. The detonator must be entirely embedded in the dynamite.

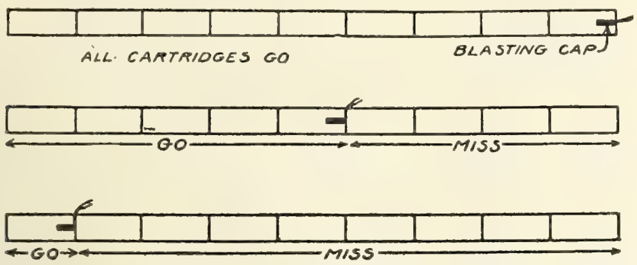
The loaded end of the detonator, or the closed end, or the "business end" should point toward the bulk of the charge (Fig. 2-A), not away from it (Fig. 2-B). The detonator should not be secured by metal wires, etc.

With an electric blasting cap, the wires should not be fastened on with a half hitch, as in Fig. 3, for although this practice is very common, there is always a chance of a short circuit occurring, especially when high-voltage power currents are used for firing.

With blasting cap and fuse, the fuse must not come in contact with the dynamite, except for about a half-inch next to the cap (Fig. 4). "Lacing" fuse through dynamite causes more burned charges than anything else (Fig. 5).

The maximum detonating effect of a blasting cap or electric blasting cap is out from the closed end. If you place a dozen cartridges of dynamite, end to end in a straight line on the ground, and fire a blasting cap in the end cartridge, with the blasting cap pointing towards all the other cartridges (Fig. 6), the entire line will go off, but if you put this primer in the middle of such a line (Fig. 7), some of the cartridges back of the detonator, that is, those away from which the detonator is pointed, will often fail to explode. If you put the primer cartridge at the end of such a line, pointing it away from the line, that is, pointing it towards the open air (Fig. 8), generally the primer only will explode. This does not always happen in a bore hole, because there the explosive wave is strongly confined, but this shows a tendency of the dynamite, which is in the opposite direction from the closed or "business end" of the detonator, to misfire. Several years ago this was demonstrated to a skeptical individual in a quarry shot, where there were 27 holes, each hole containing from 19 to 21 cartridges of dynamite; 13 of the holes having the detonator in the next to the last cartridge and pointing downwards, that is, toward the bulk of the charge; the rest of the holes having the detonator in the same cartridge, that is, the next to the last, but reversed, pointing upwards. These holes were all thoroughly tamped with sand and fired at the same time. While all the dynamite in both sides exploded, where the detonator pointed downwards the rock was broken and cleared from the ledge below the bottom of the holes; where the detonator was pointed upwards, about one-third of the distance from the bottom of the holes upwards, the rock was broken up but left in place. This showed that when the detonator pointed downwards, the full power of the dynamite was realized; where the detonator pointed away from the bulk of the charge, the full power was not realized, but a great deal was wasted.

When a cartridge of 40 per cent. straight dynamite is suspended vertically in the air, and a blasting cap supported at right angles to it, and pointing directly at it (Fig. 9) is red, the dynamite will explode at a distance of 24 ins. from the blasting cap, but if a cartridge and blasting cap are hung parallel with each other, that is, the blasting cap pointing either straight up or straight down and parallel to the dynamite cartridge, so that it does not shoot directly at the cartridge (Fig. 10), the dynamite will not explode until it is brought to a distance of 15 ins. or less. When the blasting cap is horizontal and the cartridge of dynamite hung vertically and the cap supported at the level of the middle of the dynamite cartridge but pointed so that it does not point directly at the dynamite but a little to one side (Fig. 11), this distance where an explosion occurs is lessened still more. When the cap is pointed directly away from the dynamite cartridge (Fig. 12), it will not explode the dynamite cartridge every time, even when within 4 ins. of it.



Figs. 6, 7 and 8.

The ideal primer with an electric blasting cap would be one where the detonator lies directly in the axis of the cartridge near the middle, and with the wires secured to the cartridge, in such a way that they could not possibly pull out, by some strong non-conducting material like string. By using a curved puncher (Fig. 13) it is possible to get an electric blasting cap almost in this ideal position, where it may be held in place securely by taking a half hitch with a piece of string around the wires, carried once or twice around the dynamite cartridge and tied tightly with a square knot (Fig. 14).

Another way of priming with an electric blasting cap without using string is to punch a hole through the cartridge about 2 ins. from the end and lace the electric blasting cap through this and insert it in the side of the cartridge.

With short wires, 4 ft. or less, the ends may be passed through this hole after the cap is inserted in the cartridge (Fig. 15), but with long wires it is apt to either make the hole so large that it does not make a secure fastening, or it may even cut the cartridge in two.

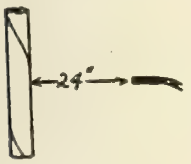


Fig. 9

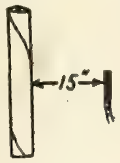


Fig. 10

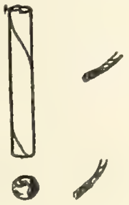


Fig. 11

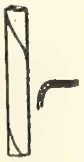


Fig. 12

With blasting cap and fuse, inserting the blasting cap in the side of the cartridge about one-third from the top and tying it tightly with one or more pieces of string, keeps the cap away from the tamping stick, and if carefully done with a curved puncher, places the cap almost in the axis of the cartridge (Fig. 16).

The orthodox method of opening up the paper at the top of the cartridge, punching a hole in the dynamite, inserting the cap and fuse into that, and then tying the paper down around the fuse as in Fig. 17, gets the blasting cap in a good position, but is a difficult operation to perform on account of the tendency of the string to slip off the paper and the difficulty of getting the string tight enough to prevent the fuse from pulling out. It also is liable to kink the fuse abruptly if the primer is seated firmly with the tamping stick.

Dynamite, when strongly confined in a bore hole, burns very rapidly when it is ignited, and on this account the lacing of the fuse through the dynamite cartridge is a practice which is strongly condemned by all explosive manufacturers. It seems strange that very much of the dynamite would burn before the cap would explode, but the fact is, dynamite burns very much more rapidly when confined than when in the open, and it has been known to burn up entirely in a bore hole which contained a perfectly good cap without any of the dynamite exploding, the cap, of course, exploding and doing no work. Burning dynamite makes a large quantity of exceedingly poisonous fumes, and a number of fatal accidents have occurred from dynamite burning up in the bore holes in mines and tunnels, due either to lacing the fuse through the cartridges, or from other causes, such as matches, sparks or burning oil dropping into the charge bore holes. These fumes from burning dynamite are so frightfully poisonous that no chance whatever should be taken of a charge catching fire, especially when it is so easy to prevent it by taking the proper care in preparing the primer.

The bane of blasters in mines and tunnels is the smoke and fumes from the explosive, and while no explosive has yet been invented which does not give off more or less irritating fumes, the quantity of fumes given off can be materially decreased by insuring complete detonation of the charge by using the strongest obtainable blasting cap or electric blasting cap, by inserting the primer in either the last or next to the last cartridge in the hole, and placing the detonator so that the "business end" points towards the bottom of the hole. It is advisable to place one cartridge on top of the primer as it serves to cushion the primer from the tampering stick when used for packing the tamping. The stronger the confinement and the larger the detonator, the more perfect the explosion will be, and the less the amount of noxious fumes.

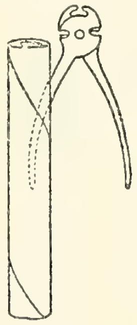


Fig. 13

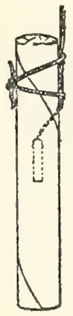


Fig. 14

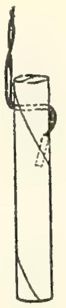


Fig. 15

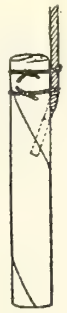


Fig. 16

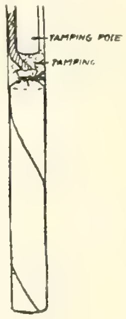


Fig. 17

Discussing the position of affairs in the Canada Cement Company, the General Manager, Mr. F. P. Jones, said that the recent order of 2,500,000 barrels of cement received from the Dominion Government was for delivery extending over four years. In addition to this, the company had orders for the Halifax dock improvements, Quebec dry docks, Montreal harbor elevator, Winnipeg waterworks development and other large undertakings running into a total of 4,000,000 barrels, including the order already mentioned. These were for delivery over the next four years, and being the equivalent of 1,000,000 a year, the company felt that it had a good basis for operations.

Processes Available for the Treatment of Industrial Wastes

THE problem presented in the treatment of industrial wastes is rapidly gaining in importance, both to manufacturers and cities. The sanitary engineer thus finds his field rapidly widening in this direction, and a study of the treatment processes available is profitable at this time.

Industrial wastes containing putrescible matter create a nuisance when discharged into water courses. Such wastes entering sewers also add to the load on plants treating domestic sewage. The latter possibility must now be kept in mind in designing new municipal sewage treatment plants. Industrial wastes may also cause deposits in streams or an oily scum on the stream's surface. Some such wastes give a bad taste to water and badly taint the flesh of fish. Thus petroleum refinery wastes give a kerosene taste to water and gas and tar works wastes taint fish.

Sometimes, but by no means always, the treatment of industrial wastes leads to the recovery of valuable by-products and is carried on at a profit. Thus fine screens in pulp mills save much finely divided pulp. In general it is unsafe to assume that a direct profit can be made in the treatment of industrial wastes. However, an indirect return is received by removing the cause, and subsequent cost, of litigation.

In some small plants the facilities of the large plant for making by-products are lacking. However, careful inspection by an outside engineer will frequently show leaks which can be stopped at small expense with comparative profit to the manufacturer. In the tanning industry pieces of skin and even whole hides have been lost to the sewer by lack of proper floor screens and catchbasins. In one wool scouring plant so much wool went down the sewer that the owners refused their operating engineer the privilege of keeping the catchbasin clean for the wool recovered.

In the location of new plants a manufacturer should bear carefully in mind the almost certain probability of regulation of the discharge of waste. Hence it would seem wise to locate plants producing large amounts of waste difficult of treatment on the largest bodies of running water available. Unfortunately, in many cases this is not done, and a plant is built on a stream which furnishes hardly enough water for an adequate water supply, and then a nuisance results.

CLASSIFICATION OF WASTES

From the physical and chemical standpoint the various wastes can be classified as follows:

1. Wastes carrying sediment or suspended matter. (a) Heavy mineral matter, such as marble dust, ashes, etc., usually inert. (b) Heavy matter, such as the product of chemical reaction, as tarry wastes from gas works, residues from ammonia works, etc. (c) Heavy organic matter—which may be highly putrescible, or comparatively inert.

2. Wastes carrying little or no sediment. (a) Containing soluble organic matter, which may be highly putrescible. (b) Containing chemicals. 1. Eager to absorb oxygen. 2. Inhibiting bacterial action.

3. Wastes carrying both suspended and soluble matter.

4. Wastes carrying floating materials. (a) Volatile and inflammable, as, for instance, gasoline or kerosene. (b) Fats and oils. (c) Light organic matter. (d) Light matter the product of chemical reaction, as floating material from gas wastes, etc.

These classifications are of service to indicate simply the general types of material which may be present. The wastes to be handled vary considerably with the industry, and even among plants of the same industry, according to the processes used and the material produced. The prevalent waste differs in the various States. In Indiana, for instance, strawboard wastes are very common, whereas in Ohio creamery and wire mill wastes occur, in Maine the pulp and sulphite waste, and in Illinois the wastes from the packing houses, tanneries, starch works and distilleries are most common. At times canneries give trouble. These are usually found near the agricultural districts.

PROCEDURE IN TAKING UP A PROBLEM

In studying an industry from the standpoint of treatment of the waste, the first essential is to learn the processes carried on and the probable sources and amounts of waste. Seldom does the manufacturer know just how much sewage he is discharging. A thorough inspection of the plant in all its details is of value, for frequently the study of the inside workings reveals many points at which waste can be reduced with comparatively small expenditure of material and labor. No general method of procedure can be stated, as each plant is usually a law unto itself. At times separation of the wastes may be desirable, whereas in other cases, as for instance in tannery work, the effluent from one part of the plant contains chemicals that may be of material value in precipitating material held in suspension in the effluent from another part of the plant. Under those conditions mixing of the wastes is of service. Rain and surface water drains generally should be kept out of the sewer systems receiving waste, in order to avoid at times of rain serious overloading and scouring out of the material which should be retained.

TREATMENT METHODS AVAILABLE

The methods of treatment available are somewhat more varied than for domestic sewage, although for the most part the same general principles apply. The difficulty is, of course, to find the proper constants and loading which can be used to produce results. Owing to the diversity of practice in many plants, the sure way is to try out what can be done with the individual case in question.

Dilution.—With wastes containing no suspended matter, ample dilution frequently suffices. Sometimes this dilution can be furnished artificially from storage reservoirs. Again, it is available in large streams, such as the Mississippi or other rivers with sufficient flow. Where the dilution is not adequate, and velocities are low, the suspended matter in wastes containing such must be reduced in order to avoid deposits in the stream. Screening and sedimentation are available for this purpose.

Screening.—Screening seems eminently suitable for the coarser wastes, such as come from the stockyards, slaughter-houses, beet sugar works, pulp mills, etc., where material slow to digest can be readily removed by a fine mesh screen. The disposal of the screenings when putrescible may, however, be complicated with the problem of avoiding nuisance. Sometimes the material can be dried and burnt. Occasionally it can be turned back into the processes. Directly comparative results available in the packing industry would indicate that considerable material is left over after fine screening, which can be removed by settling. However, the screening removes much which is slow to settle and is a source of scum in sedimentation tanks.

Settling.—Settling should remove practically all the settling suspended matter, the actual per cent. depending on the waste, the period of settling, the type of tank and the velocities used. A doubledeck tank is frequently most suitable where much scum-producing material is present. In extreme cases, fine screening has been proposed as a preliminary treatment to reduce the scum-forming material. With comparatively inert material, the Dortmund type of tank with sloping bottom may prove successful if properly and frequently cleaned. On tannery waste, particularly from the limes, heavy material is present which will quickly settle. In wool pulleries or wool scouring shops much heavy grit is produced which also drops quickly. For such gritty waste a grit chamber design readily cleanable is desirable. Unfortunately, many of the tanks now in operation in tanneries and elsewhere are expensive to clean, as the entire work has to be done by hand on days when the plant is shut down.

Chemical Precipitation.—Chemical precipitation may materially increase the removal of suspended matter by settling, and in some rare cases may be produced by the combination of chemicals already in solution in wastes from the various processes in the plant, particularly in tanneries.

Septic Tanks.—Septic tanks were once widely used in the past, and are used occasionally today, despite their limitations, on creamery, canning and tannery wastes where organic matter slow to decompose needs breaking down. As a rule, however, the septic tank is not regarded favorably on account of liability of nuisance and the larger storage required to hold liquid for many days.

Filtration.—Very frequently further treatment is required to produce an effluent needing but slight if any dilution. In Massachusetts intermittent sand filters have been used freely in experimental work, as well as in actual practice, but of late sprinkling filters have been found helpful, particularly as a preliminary to intermittent sand filtration, in connection with tannery or other wastes high in organic matter, thereby permitting much higher rates of application to the sand filters. In Chicago, on the mixed waste from Packingtown, a sprinkling filter has proved adaptable in handling mixed stock-yards and domestic sewage thoroughly settled. Owing to the possibility of deposits of grease in such a filter, its history is being watched over several years.

Evaporation.—Occasionally a waste is so difficult to handle and contains so much material in solution that evaporation appears to be the only remedy. Although the economy of evaporation is markedly increased by the use of several effects, the process is expensive, particularly for dilute wastes. It has, however, proved practicable in the packing industry for evaporating "tank" water from the rendering tanks which contains matter of value as a fertilizer, and has also been applied in evaporating distillery wastes, as well as in recovering chemicals from industrial processes where they can be used over again to advantage and profit.

SLUDGE

Amount.—As in the treatment of domestic sewage, a sludge problem soon arises, for the quantity of sludge found in industrial waste is frequently much greater than in domestic sewage. The amount varies widely. In the mixed waste tested at the Centre Avenue testing station of the Sanitary District of Chicago the amount of sludge in an Emscher tank was approximately 10 cu. yds. per million gals., as compared with about 1 cu. yd. found at the 39th Street station on domestic sewage. In the tannery tanks with plain sedimentation from 10 to 100 cu. yds. per million gals. are found. However, in the tannery industry the flows are not usually great, so that the total volume of sludge produced in a day is not quite so appalling as the figures might indicate, although large enough.

Treatment.—The treatment of the sludge depends largely on the waste itself. Where there is a large mass of material to be disposed of with little value except for filling, the expense is for transportation to the nearest dump. Frequently with proper treatment on organic wastes, a quick drying sludge may be produced, as for instance by the use of the double-deck type of tank on the mixed packing-house waste. Such sludge may contain some nitrogen, but is not commonly regarded at present as a valuable material. Sludge pressing may reduce the water content. Under certain conditions the sludge itself may prove of value for the recovery of fat, and once the fat is extracted, the dried sludge may serve as a filler for fertilizer. The basic value as a fertilizer from the laboratory standpoint may be doubtful on account of what the chemists call the difficulty of the assimilation of the nitrogen by the soil. A sure test is the actual trial of the sludge in the field.

OXYGEN DEMAND

In testing the strength of industrial waste the sanitary engineer is primarily interested in the oxygen demand, particularly where the stream flow available is limited. This can best be determined by the use of a dilution test or the nitrate test devised by Dr. Lederer. The comparison of strength of sewage by this method is of value, and is impressive even to the layman. In the Sanitary District the domestic sewage at 39th Street has been found to have a bio-chemical oxygen demand averaging 100 to 125 p.p.m., with a consumption of approximately 25 to 30 per cent. in the first twenty-four hours at 20 deg. C. The mixed stock-yards and packing-house wastes average 900 to 1,300 p.p.m., with a consumption of about 20 per cent. in the first twenty-four hours. Tannery wastes vary considerably, ranging from 400 to 1,000 p.p.m., with consumption averaging around 7 per cent. in the first twenty-four hours. The consumption in the first twenty-four hours at 20 deg. C. has a direct bearing on the condition to be met in a stream if twenty-four hours is the interval of time to the critical point. Other time periods may be taken for study, if desired, to meet local conditions.

DESIGN OF WORKS

In the design of works to handle industrial waste, the manufacturer is usually anxious to cut the cost of installation to a minimum, and consequently the most careful designing is required. Where a plant is located in a city in the midst of a built-up region, lack of space is a great handicap. Although willing to employ legal talent, the manufacturer is frequently averse to engaging competent engineering advice. Consequently it sometimes happens that more funds are frittered away in ill-considered experiments than would produce a practical working plant for service, and this phase is occasionally complicated by the eager salesman who urges devices which from their very principle could be ruled out as impractical or insufficient from the start.

Inside any industrial plant, self cleansing sewers are a necessity, with plenty of man-holes for ready inspection. In the tanning industry provision should be made on the floors at all inlets to the sewers to hold back large pieces of material, such as skin and the like, by suitable screens of perforated plates set in the floor over the outlet drains. Some of the most up-to-date factories are equipped with catchbasins under every inlet. The exact efficiency of this is, however, unknown. On lines of sewer the use of fine screens may be desirable to separate out material that is hard to handle and material which might interfere with the proper working of pumps or other machinery.

Settling tanks should be designed for ready cleansing, as hand cleaning is expensive, although still practised in most tanneries. The experience in the Chicago District would indicate that a tank with bottom slopes over 45 deg. and near 30 deg. from the vertical will feed the sludge to the centre of the tank. However, the sludge may become so caked, if cleaning is infrequent, as to be difficult to pump. Compressed air, water or steam introduced at the bottom of the tank just before pumping will break up the sludge and render it easily handled. Wool, leather strips or other foreign material which will tend to clog a small centrifugal should be screened out. Ample sludge drying beds and sludge storage should be provided.

Skimming basins are also useful to hold back grease, or light oils. Grease may occur either in a form which tends to float, or to be held in suspension or to sink. In hot liquids, basins or large surface area are used. These are the reverse of settling basins, in that scum retaining baffles are provided with scant sludge retaining features. Among these are found the skimming basins built to catch oils from the locomotive shops or roundhouses, as well as to catch tar and refuse escaping through the sewers from gas works, and works for the utilization of tar and gas works waste. In many cities there are now municipal requirements in force which require traps to retain gasoline and oils escaping from garages. In Chicago a triple basin is used suitably trapped and baffled for this purpose.

The sanitary engineer today realizes that sewage can be treated either by aerobic or anaerobic methods to arrive eventually at the same stage, the breaking down and transformation of putrescible organic matter. The anaerobic methods attack organic matter vigorously, but are difficult to control and liable to produce serious nuisance. Consequently, the sanitary engineer has endeavored in the treatment of domestic sewage to keep the sewage as fresh as possible throughout the sewers and treatment. In the height of the septic tank vogue the anaerobic decomposition applied too generously disgusted many manufacturers and proved to their minds at least, from the foul liquids and odors produced, that their wastes were incapable of any treatment. However, other methods available today of screening, settling and aerobic treatment should be tried before final opinion is pronounced. It is rather curious that the septic tank should have been discovered in England and there patented, when for years the Chicago River and Bubbly Creek had been operating as a septic tank, probably the largest in the world, yet censured by all who passed by. Consequently, with Bubbly Creek as an example, it is now difficult to see why the same method was followed in the hope of securing results free from nuisance. In any sewage treatment, either industrial or domestic, the greatest possible freedom from odors is desirable, as well as absence of ill-smelling liquids. Hence the suspended matter should be removed as quickly as possible. There may, however, be some wastes in which the use of septic processes is still of service.

In approaching the manufacturer it is unwise to arouse any false hopes as to the possibility of recovering values from the wastes. As a rule the manufacturer feels that little escapes to the sewers of value to him, and promptly forgets that much may escape which is troublesome to the sanitarian.

The municipality has a basic interest in the wastes discharged by industries, even though the domestic sewage be not treated, from the standpoint of sewer maintenance. Consequently, in most cities ordinances will be found regulating the methods of entrance to the sewers, and prescribing catchbasins and other devices suitable to retain settling material which may cause deposits. Oil is also undesirable. Gasoline and other volatile fluids should rigorously be kept out of the sewers. The intelligent interpretation of these ordinances by an engineer familiar with industrial processes and the application of engineering principles materially helps in holding back a great deal of material at its source, and by so doing relieves expensive maintenance of the sewers. Recently in another city paunch manure from packing-houses completely stopped a 24-in. outfall sewer for a distance of 120 ft., flooding the adjoining back yards. This necessitated the removal and rebuilding of the sewer.

SEPARATE VS. MIXED TREATMENT

The question of treatment and whether it is best to treat industrial wastes separately or mixed with domestic sewage is a problem which must be solved for each case. However, the principle seems clear that many wastes which are difficult of treatment alone can be more readily handled when diluted with domestic sewage. In this classification, particularly, are wastes which are sterile at their source and which by dilution with domestic sewage are thoroughly seeded with bacterial life required for self-purification. Wastes slightly acid may be neutralized by the alkalinity of the sewage and seeded thereby. The problem is largely one of economy and expediency for each locality. Occasionally hints can be gained by comparison of methods employed in different industries. For instance, in the mining field a great deal has been accomplished on special devices for the classification and concentration of fine slimes to secure economy in cost and operation. To some other industries these same devices may be applicable.

The foregoing discussion of the engineering features of industrial waste treatment is an abstract by Engineering and Contracting (Chicago) of a paper by Mr. Langdon Pearse, Division Engineer, in charge of the sewage disposal investigation for the Sanitary District of Chicago, delivered at the annual meeting of the Indiana Sanitary and Water Supply Association.

The St. Lawrence Brick Company, Limited, have removed their offices from La Presse Building, to 71 St. James Street, Montreal.

Corrugated Pipe Used Successfully for Culverts

CORRUGATED pure-iron pipe has solved the problem of how to replace failing timber culverts under high embankments on the Western Pacific Railroad without disturbing the fills. The cost of concrete would have been prohibitive, and cast-iron was also out of the question on account of the difficulty of handling of heavy lengths inside the old culverts. The ability of corrugated pipe to accommodate itself to the settling of embankments and to dispense with absolutely rigid foundations was another argument in favor of its use.

During the construction of the road in 1907 a considerable number of timber culverts had been built. The timbers were of 12-in. Douglas fir. The side timbers were laid on top of each other and drift bolted together. Floor sills were laid on 4½-ft. centres. The floor planking was 4 x 12 in. Standard sizes in these culverts were, 3½, 4½ and 5½ ft. square.

During the past year or two it has become evident that many, if not all, of these would soon require replacement with more permanent material. As many were installed under very deep fills, to accomplish this with concrete or cast-iron would have been very expensive. Corrugated pure-iron pipe was decided upon because it was found practicable to install this in the nestable form inside the wooden culverts and tamp the filling effectively around the pipe. This method showed a great saving over any form of construction which involved completely excavating the old work, and, from the behavior of the first installations of the kind, seemed likely to give very good service.

For this purpose the nestable Armco (American Ingot) iron culverts come in semi-circular sections 2 ft. in length, provided with a special connector for drawing half sections together, which, under these circumstances, must of course be operated from the inside of the pipe. For these installations the fill is not disturbed, but the floor of the old timber culvert is removed.

Where the timber culvert has been crushed by the weight of fill, tunnelling becomes necessary. Little lagging is required, 2 x 8-in. head boards and 4 x 4-in. uprights being used instead. As the culvert is installed, the uprights are removed and the head boards allowed to remain in place. The 2-ft. sections are assembled inside the timber culvert and the backfilling and tamping accomplished as each section is put in place. This is considered an extremely important feature of the installation, and the practicability of thorough backfilling and tamping in this way was the principal reason for the choice of this form of culvert. The minimum backfill is 6 ins. on the sides and 12 ins. on the top.

The culverts are 36, 48 and 60 ins. in diameter, these being installed inside the timber waterways of square dimensions, 6 ins. greater in each case. The material is No. 10 gauge. The fills vary in depth from 8 to 100 ft. or more.

Careful experiments made with this type of nestable culvert indicate that it will carry approximately 90 per cent. of the load of a full-circle continuous riveted corrugated pipe; and the experience of the Western Pacific is that in the sizes and gauge mentioned and with due care in installation it will give good service under rather severe conditions.

With the timber culvert cleaned out in advance, four men will lay this form of nestable pipe, per day, approximately as follows: 36-in., 40 to 42 ft.; 48-in., 50 ft.; 60-in., 30 to 32 ft.

Where the fills are not more than 8 ft. deep it is found economical to excavate from the top and place full-circle, continuous riveted Armco corrugated pipe. In these cases the top and floor of the timber culvert are removed but the side walls are allowed to remain. The pipe is installed in sections from 8 to 12 ft. in length. The diameters employed are 18, 24, 30, 36 and 48 in., these being of 10-gauge material. The weight of these sections will not exceed 1,000 lbs., even in the largest sizes. The sections are equipped with a convenient lug coupler for making the connections. These pipes are also carefully backfilled and tamped, this important part of the work being easily accomplished in the open ditch.

For both types of corrugated culvert, head walls are made of stone laid in cement, precautions being taken to prevent water getting under or around the sides of the pipe.

Approximately 8,000 ft. of this corrugated pipe have been used since October 1, 1914, for the replacement of these timber culverts. All of these installations are entirely satisfactory.—Engineering Record.

Architectural Acoustics

IN order to determine the acoustic properties of a building it is no longer necessary to wait until the auditorium is finished and then endeavor to ascertain whether it is good or ill, says Dr. Wallace C. Sabine, Dean of Graduate School of Applied Science of Harvard University, in an article which appeared in the Journal of the Franklin Institute. While the factors of the acoustic problems in an auditorium at all complicated, are themselves complicated, nevertheless they are capable of exact solution or at least of a solution as accurate as are the architect's plans in actual construction. This conclusion is given as the result of experiments extending over a period of ten years and begun in some of the buildings at Harvard.

The question of reverberation of sound was first studied. The principal point there is the absorption of the sound, that is, its transformation into another form of energy. It was found that cushions placed in the seats materially diminished the reverbation and further experiments in absorption showed that the audience itself and heavy hangings three or four inches from the wall were the best absorbers of sound. It was discovered that wood sheathing was a better absorber than plaster, glass or brick.

While materials are the principal feature in reverberation, faults in which can consequently be corrected with comparative ease in an auditorium already built, the shape of the room itself is the best factor in interference—the conflict in sound waves reflected from projecting surfaces, which sometimes continue a sound unduly, sometimes make an echo and sometimes either directly conflict or directly augment each other so as to double or annihilate a sound. Hence the so-called "loud regions" or "deaf regions" in an auditorium. From the experiments, experts in acoustics can now determine by an inspection of the plans of an auditorium whether or not it will be possible to hear well in it, and if not just what should be done to improve it.

Owing to the increasing cost of timber for coach building, the possibility of constructing passenger stock of steel is being considered by the authorities of the Union of South Africa railays, and the chief mechanical engineer has been authorized to order two trains of steel coaches for trial.

Construction Designed to Reduce the Cost of Brick Roads

BRICK laid on a very thin reinforced concrete base is the construction proposed by Professor James S. Tucker, Director School of Civil Engineering, University of Oklahoma, to reduce the cost of brick road construction. The full discussion of his plan is given in a paper presented recently to the Iowa State Engineering Society, and abstracted by Engineering and Contracting.

A large portion of the paper by Prof. Tucker is devoted to a proof of the fibrous structure of paving brick, and to a discussion of the advantages of placing the brick in pavement so that wear is across the fibre, with a plea for a soft joint filler instead of grout filler. The paper then presents the facts and reasoning supporting the proposed new construction, and these we give here somewhat condensed from the or-

Results of Tests

Late in 1912 there were made in the engineering laboratories at the University of Oklahoma a series of tests to indicate the behavior of concrete pavement foundations. Concrete slabs, representing a section of the pavement 1 ft. wide of various thickness when suitably aged were placed in the testing machine and supported on knife-edges 27 ins. apart and the load applied directly to the centre of the slab. The average centre concentrated load borne by 6-in. plain slabs at twelve days, was 1,200 lbs.; by 5-in. plain slabs at eleven days, 1,125 lbs.; by the 4-in. plain, at ten days, 630 lbs. A 2-in. slab, reinforced with wire fencing in the middle, averaged 460 lbs. at ten days or four-fifths as much as the 4-in. plain; 3-in. slabs, reinforced near the bottom, gave 1,180 lbs. in ten days; or the same as the 5-in. slab and nearly as much as the 6-in. Four-inch slabs, also reinforced near the bottom, gave 1,150 lbs. in ten days. One 4-in. slab with three wires at age of 27 months gave the remarkable test of 3,000 lbs.

The reinforcement used in every case was ordinary commercial rectangular mesh hog-fencing of galvanized wire, costing from 3 to 5 cents per square yard in place in the street foundation. The slabs tested had either three or four longitudinal wires, just as it happened to come from the top or bottom of the fencing. The meshes ranged between 5 x 6½ and 3½ x 6½ inches. The top of the fencing had wires of ⅛-in. diameter, while the balance were 9/16 in. diameter, and the transverse knotted stay wires were 7/64-in. In none of these cases did the wires break except in the 27-month test, but as the ends of the strands were not even turned up, or hooked, and as in numerous specimens the wires were embedded only about ¾ in. from the bottom of the slab, they frequently pulled loose and slipped as the upper part of the slab crushed under the load. The concrete was of the most ordinary sort, made in a hand mixer, proportion 1:4:5, with ¾-in. limestone, and a coarse and a fine grade of sand in equal parts. The slabs were aged in an open field between October 28 and November 12, for the most part.

The significance of these tests appears when we consider the cash value of the facts learned. Wherever there is need for a 6-in. base, one 3 inches thick with 5 cents' worth of reinforcement will do equally as well. The cash saving is notable, since the concrete will cost from 15 to 20 cents per square yard per inch of thickness. Hence this simple use of hog-fencing means from 40 to 55 cents per square yard of pavement actually saved, or 25 per cent. saving on a pavement costing from $1.60 to $2.00. This is a saving of $1,000 upon about 2,000 sq, yds. of pavement, and a small job of paving usually runs to several times this amount. Nor is this all. Having seen that we can do with 3 inches of concrete all that is now done with 6 inches, the next obvious question is: Is a pavement base of even that strength ever needed?

It will be observed that the loads of 1,500 lbs. obtained with the 4-in. slab represent a wagon wheel carrying one-fourth of a three-ton load. This is probably about twice as great an intensity as would occur for a ten-ton road roller, and somewhat greater than under a large traction engine. Note, however, that the slab tested had the following very great handicaps: first, the load was applied at the centre of a clear unsupported span of 27 inches. Second, the slab was discontinuous in both directions, and hence could receive no support from adjacent portions of the concrete. Third, this discontinuity, of lack of anchorage, was of vital importance to the reinforcement, since only in the one case of the block aged 27 months did the wires break. That is, the capacity of the wires missed development by from 50 to 80 per cent.

The most vital variation between this experiment and practice, however, lies in the unsupported span tested. We certainly need not assume that we must design to meet this non-supported condition in practice. Nor need we figure safe loads without taking into account the supporting power of the sub-grade. Every engineering text on foundations suggests that almost any dry soil can be safely relied upon to carry two tons per square foot, if kept free of excess moisture. The soil will be very bad indeed which will not carry one ton per square foot, and for particularly good ones it may run to eight or ten tons. Taking two tons as a reasonable figure for soil which is to have a tight roof, and which may be assumed to have received the attention of a steam roller, this would give a supporting capacity of about 30 lbs. per square inch, running up to six or eight times that with the better soils.

If we consider a 3 x 8-in. brick as receiving a wheel-load of 1,500 lbs., and as resting on a 1-inch sand cushion carried by concrete 3 inches thick, then taking the usual assumed divergence of load lines as 45 deg., this wheel load is distributed over 170 sq. ins. of earth surface, giving an intensity of 9 lbs. per square inch. Since we are counting upon a 30-lb. soil as a minimum, which figure already includes an ample factor of safety, it is evident that the soil can not be overstressed, even though we consider the area of concrete loaded as a separate flagstone, and not part of a continuous slab, which it certainly will be.

Without assuming that our foundation has any particular tensile strength, therefore, we are forced to conclude that a soil area of 50 sq. ins. would carry the 1,500-lb. wheel load with perfect safety, while in fact the area receiving the load is over three times as great as this. This, it is thought, will serve as an ample allowance for the case where the load is applied to the joint between two bricks where there is a non-rigid joint filler.

We thus find ourselves to have reasoned around to our starting point, the contention of MacAdam that a well-drained and compacted road surface would bear any wheel loads that could be put upon it. We see that if a space 4 inches long under our 12-in. wide test-slab had been occupied by soil of the supporting capacity named, instead of the slab having a clear unsupported span, then there would have been no need of reinforcement in it.

Pursuing the logic still further, it appears that the thickness of the slab is of little import, since it is the subgrade which must really and eventually carry the load in any case. As the thinner slabs deflected about ¾ in. without falling, it is seen that the soil area called into support will greatly exceed what is needed to bear any load coming upon the pavement surface.

This reasoning indicates that a 2-in. slab with the wire in the middle would be amply strong, and would effect a still further saving of money over that already indicated. The speaker is not prepared to recommend this thickness, however, unless the paving specifications are otherwise radically amended, notably in the preparation of the subgrade. He is convinced, however, that an average expenditure of 3 or 4 cents per square yard in excess of the present practice devoted to watering, raking, and continued rolling of the subgrade would render the 2-in. base entirely feasible. He is also convinced that such rolling and painstaking treatment of the subgrade would surpass in effective supporting power and increase pavement stability more than the introduction of four extra inches of concrete foundation as now commonly practised, while the cost reduction might then amount to 30 per cent. of the total.

It may here be claimed that this paper first makes a great argument for wire reinforcement, and then shows that it is unnecessary. The practical difficulty of getting a uniform and homogeneous subgrade is freely admitted, even with the care and effort here asked for. This is exactly where the reinforcement comes in,—to render the pavement stable and secure from disturbance by reason of such defects in its support, for if these thin slabs with the trifling reinforcement used, will under all the handicaps herein indicated virtually carry any possible loads over clear spans of 2 ft., it is certainly rational to suppose that they will carry and distribute the loads properly when resting on almost any soil short of liquid mud. This we certainly need not provide for, nor need we regard a general settlement in any pavement as fatally defective.

Having now considered the pavement foundation at length, let us turn back and see what bearing, if any, this discussion has upon joint fillers, and its possible relation to the shape and size of the brick. To the speaker there is a most profound and significant relationship between all these factors. It is thought that those who have contended most strongly for the rigid cement grout filler do so through failure to recognize fully the meaning of the MacAdam principle. They have seemed to consider that the brick wearing surface must not only furnish a strong wearing surface which would then resist the abrasion of traffic, and that it must also perform all the functions of the foundation as well. As already suggested, if temperature stresses did not enter into the problem results under this theory might still be fairly satisfactory. But since temperature strains are bound to occur, and are likely to cause cracks and fractures, why not guard against them by using ample expansion joints around each brick, and use bituminous filler. If the foundation and subgrade have been planned and executed to develop their legitimate functions then there is no need for the wearing surface to attempt to include that also, and perfect stability of the wearing surface is insured not by attempting to make it immovable and unbreakable in itself but by furnishing it with a strong immovable and unbreakable support.

It is at once evident that the single quality which has given brick such a prominent place as a paving material is its wonderful resistance to abrasion. Even where paving has been done in violation of all the principles herein studied no one has yet seen a brick pavement really worn out. It follows therefore that with an adequate support provided, and temperature stresses relieved as above outlined it will then be preeminently sound engineering design to lessen the thickness of the wear resisting surface. The speaker believes that 2 or 2¼-in. paving brick laid flat with a bituminous filler, upon 1-in. or less of sand supported by a 2-in. reinforced foundation, all borne upon a carefully, but cheaply, prepared subgrade, represents the distinctly modern type of economical pavement construction for every sort of traffic except the most intense steel-shod traffic when bricks of the usual thickness would be economical. Also with subgrades of special difficulty as to drainage and known instability of soil an extra inch might be added in the foundation.

Watertightness of Gravel Concrete*

ALTHOUGH the specimens of concrete examined varied in proportions up to 1:9, most of them were so impervious that no visible evidence of flow appeared. For most purposes such concrete can be considered watertight. By grading the sand and gravel in accordance with Fuller's curve it was possible to obtain practically watertight concrete of 1:9 proportions under pressures less than 40 lbs. per sq. in.

In the proportioning of the materials, volumetric analysis, coupled with a determination of the density and air voids, yields valuable information concerning the best proportions of sand and gravel for a given proportion of cement. If proportions must be selected arbitrarily a 1:1½:3 mixture, by volume, is very impervious.

The use of the proper amount of water necessary to produce a medium consistency is one of the most important conditions in securing impervious concrete, especially when poor mixtures are used. On the other hand, a wet consistency does not materially affect the imperviousness of rich mixtures, such as 1:1½:3 concrete.

No process in the making of impervious concrete is of more importance than curing. The results of these tests clearly demonstrate that premature drying destroys the imperviousness of 1:9 mixtures, seriously impairs that of the 1:2:4 mitures and somewhat diminishes that of 1:1½:3 mixtures. For thin sections, not over six or eight inches thick, the curing conditions should be such that a lean concrete will be kept damp for a period of one month and a rich concrete for at least two weeks. Even after a month of proper curing, the complete desiccation of a poor concrete produces an increase in permeability, but the effect on a rich mixture is not marked. In these tests the imperviousness of the concrete increased rapidly with the age of the specimens for the first month; thereafter the change was not marked.

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* Notes from a paper by Professor M. O. Withey, before the Western Society of Engineers, describing the results of a series of tests made at the University of Wisconsin.

Corrosion of Naked Steel in Sea Water

THE perishable nature of unprotected steel in maritime structures is emphasised in a paper read to the Institution of Civil Engineers by Mr. S. H. Ellis, M. Inst. C.E. Referring to three steel wharves constructed during 1907-9 in Hong-Kong Harbour, the author says that in 1906, examination was made of some steel-joint piles which had been in place for about four years, and they were found to be corroded in a curious and rather alarming manner.

The piles were coated with barnacles and other shell-fish, and with a dense vegetable growth, particularly from near the surface of the water to 15 ft. or so below it. It had been an accepted theory that this growth protected the metal and prevented rusting. On scraping away the growth from a pile of the wharf examined, however, it was found that a large number of pits had formed in the surface of the steel, varying up to 1¼ ins. in diameter and ⅜-in. deep. They were full of a black powder, which also occurred in a thin layer on the surface of the unpitted steel and was found to be sulphide of iron (FeS). Apparently, some shell-fish or marine growth attached to the piles produces sulphuretted hydrogen when dead and decaying; this gas attacks the metal, with accentuated action in certain spots, producing the pits described; and when once the process is started, the deposit of sulphide facours more rapid erosion beneath it.

The author examined also some steel piles, which had been in place only 3 or 4 years, and estimated that 10 per cent. of the metal was eaten away in some sections, chiefly in the form of pitting.

As a result of his inspection the author recommended that the piles and lower bracing of the main wharf should be encased in 1:2:4 cement concrete; and it was eventualy decided to encase the whole of this structure, leaving the other wharves with bare steel, which was painted with anti-corrosive composition on erection.

The amount of polish which can be given to the surface of concrete depends upon the density of the mixture and the nature of the aggregate used. The process of polishing as described in Concrete-Cement Age, by Mr. C. W. Boynton, is as follows:—After the surface has been smoothed down on a rubbing bed, or by the use of rotary rubbing stones, as applied in terrazzo floor work, the procedure is somewhat similar to that used in polishing granite or marble. The aggregate exposed on the surface by the rubbing process takes the polish, the appearance of the surface being dependent upon the percentage of aggregate exposed.

A novel form of electric vehicle is in use in the Panama-Pacific Exhibition in the shape of a two-seated miniature car with basketwork body, capable of a speed of three miles per hour, to take the place of the wheeled chairs which have been a feature of many exhibitions. The "Electriquette," as it is called, has battery power sufficient for eight hours' running.

Removing Stains from Stonework

IN the first place, it cannot be insisted upon too strongly that no stone now accepted as a standard in the market contains within itself the elements of staining or discoloration. It may change its color somewhat in weathering, but this will be in the way of a mellowing of tone, and will give no unsightly blotches. This is proved by the natural exposure of the rock in the quarry. Where there is staining in the walls of a building, it can safely be set down to faults in the setting, or to some cause extraneous to the stone itself.

The most prolific source of trouble, says a writer in Stone, is, of course, the cement that is used in setting the stone. Ordinary Portland cement will badly stain almost any stone. Various so-called "non-staining cements" are widely heralded, but it is the universal experience of stonemen that little dependence can be placed on these.

In the old days, before cement was so widely used, architects rarely had to complain of staining. There are thousands of buildings that have stood for half a century or more that show only the kindly mellowing of time, save for the effect of smoke and dust incidental to city life.

Architects will specify very particularly that stone be set in cement mortar and think that they guard against all trouble if they require the back and sides of the stone to be coated with waterproof paint. Undoubtedly a good paint is much protection, but the difficulty is to coat the beds and joints of each stone clear to the face. A narrow strip left unpainted will permit the carrying of the discolorating moisture from the cement to the face of the stone by capillarity.

All of this trouble could be avoided if the architects would only insist that the stone be set entirely in lime mortar, made in the following proportions: one part lime and three parts sand. The lime to be thoroughly slaked and the sand well tempered; all mortar to lie in the pile at least twenty-four hours before using; all sand to be clean, coarse, and free from loam. If the most delicate stone is set in mortar as above, and the back of the stone plastered with the same mortar, it positively will not stain.

There is another way in which stone may be stained—by the drippings from concrete floors or roofs. In such cases the discoloring moisture runs down the face of the stone, and no painting of the back or beds can afford any protection. The utmost care in superintending the construction is the only safeguard from this disfigurement.

Cement stains cannot be eradicated by any wash or other treatment. Fortunately, they are apt to bleach out in time under the influence of the sun and the weather. The architect and the owner alike are naturally greatly exercised when cement stains appear, and try to seek some immediate remedy. The only thing to do is to have patience and wait for the natural bleaching, which may take weeks or even months.

The stone setter, anxious to leave a building in spick and span condition, may suggest that it be washed down with muriatic acid. This should never be permitted. The acid may take out some of the stains for the moment, but it burns the surface and eventually will discolor even those portions that escaped the original staining.

There was a time when scrubbing with wire brushes was permitted, but this has generally been discarded, since its bad effects have been recognized.

It is impossible to use wire brushes without leaving a coating of iron on the surface of the stone, and this is bound to leave a worse stain than it corrects.

The sand blast is sometimes employed, but generally for old buildings that have become discolored from smoke and soot. This method should always be discouraged. The sand strikes the stone with a tremendous impact. It destroys the "skin" which forms on the surface of the stone by deposition of mineral ingredients on the evaporation of the interstitial water. It also stuns the grains or crystals of the stone and tends to hasten the weathering.

The very best treatment of stone to remove smoke, soot, dirt, mortar, etc., is a simple washing. A recipe that is recommended by stonemen of the widest experience is as follows: prepare a wash of soft water and about one and a half bars of common laundry soap. Boil until the soap has been thoroughly dissolved. Add a fine, clean, gritty sand (white preferred) and mix to about the consistency of putty. While mixing add about five tablespoonfuls of ammonia to a bucket of water. With this preparation scrub the surface with a stiff scrubbing brush, wash down with a stream of water from a hose, and then go over it again with a scrubbing brush.

While any building may need a cleaning, a great deal of the staining could be avoided if more care were taken. While speaking of the evil effects from cement and the dripping of dirty water, there are other things to be guarded against. The rust from improperly protected iron or steel and the verdigris from copper or bronze sheathing have disfigured many a fine structure. The writer knows of one very costly building where the oil-saturated exhaust steam from hoisting engines was discharged directly against the facade. What wonder if this is permanently stained? Doubtless the architect is speculating as to the cause of the discoloration, and it inclined to blame the stone.

Brick Pavement Details

THE subject of brick pavements, with special reference to those laid in Ohio, was treated of by John Laylin, division engineer of the Ohio Highway Department, in a paper before the American Road Builders' Association. He described the standard method of building brick pavements (practically that recommended by the National Paving Brick Manufacturers' Association) and in conclusion described briefly a few details of certain roads in his state. A stretch of the Cleveland-Buffalo highway in Lake County, 2½ miles long has a brick surface 18 feet wide curbed on each side, and with a 24-inch concrete gutter having a 2½-inch concave surface. These gutters collect the water from both the pavement and the lawns and conduct this to catch basins connected with a system of underground drains. The lawns slope back from the gutters and the park-like effect is very pleasing. Two streets in Norwalk, Ohio, have been laid on natural bed foundations and edged with vitrified curbs. These curbs were made on a regular paving brick machine with three out of four of the cutting wires removed, thus making a block that when burned was 4 x 8½ x 51½ inches. These blocks were set with the 8½-inch dimension vertical and bedded in gravel or crushed limestone. Portland cement filler was used in the pavement. The work has been in place less than two years, but looks like good cheap pavement construction. He recommends concrete foundation, however, where traffic is heavy.

Personal Mention

Mr. F. L. Fellowes, City Engineer of Vancouver, has returned to Vancouver from Calgary after having been called east by the serious illness of his brother.

Mr. Emmett Kelly, a son of Mr. Thomas Kelly, of the contracting firm of Thomas Kelly & Sons, Winnipeg, died suddenly at Atlantic City, N.J., a few days ago.

Mr. F. W. W. Doane, City Engineer of Halifax, in a letter to hand last week, informs us that he is on outpost duty with the 63rd Regiment at the mouth of the Halifax harbor.

Col. H. N. Ruttan, formerly City Engineer, and later Consulting Engineer to the city of Winnipeg, is now engaged exclusively on military work. He is stationed at the Fort Osborne Barracks, Winnipeg.

Mr. W. Blaine Redfern, Town Engineer of Steelton, Ont., graduated with honors from the School of Practical Science, Toronto, in 1908. For three years he was employed by Messrs. Chipman and Power on sewerage and waterworks installations at Orillia, Dunnville and Steelton, Ont., at Weyburn, Sask., and Dauphin, Man. He became Town Engineer of Steelton three years ago. During his term of office he has had a wide experience in all the various branches of constructional activity which devolves upon the engineer in a growing municipality. Steelton is now a thriving town of 5,500 inhabitants. In it are situated the large steel works of the Lake Superior Corporation. It has extensive sewerage waterworks and electric light systems, as well as permanent pavements and concrete sidewalks. Its growth in the last few years has been rapid, and with cheap power and good factory sites it presents good opportunity for further industrial expansion.

Mr. W. Blaine Redfern.

Capt. Gault McCombe, of the contracting firm of Collier, Newton, McCombe, Limited, Montreal, was wounded in the fighting at Langemarck. He is a captain in the 14th Battalion. Private Peter Lyall, Jr., of the 14th Battalion, who was wounded in the head, neck and arm, is the son of Mr. William Lyall, of the Peter Lyall and Sons Construction Company, Limited, Montreal. Private Lyall, who is 21 years of age, was studying at Boston when the war broke out. He sailed from New York and joined the First Contingent at Salisbury Plains. He is now in hospital at Tunbridge Wells, Eng.

Mr. Percy A. Wright has been appointed Town Engineer of Fort Frances, at a salary of $100 a month, the engagement being for six months only.

Mr. H. H. Vaughan, Assistant to the Vice-President, Canadian Pacific Railway, in charge of the Locomotive and Car Department, has resigned to take charge of a manufacturing enterprise. He will be succeeded by Mr. William E. Woodhouse, Superintendent of Motive Power and Car Department of the Eastern Lines of the System, with headquarters in Montreal. Mr. D. T. Main, who has been in charge of the Mechanical Department at Toronto, will succeed Mr. Woodhouse.

Mr. John Kennedy, known in Montreal as "the man who made the Montreal harbor," has just celebrated the fortieth anniversary of his connection with the Montreal Harbor Commission. Mr. Kennedy is now Consulting Engineer to the Commission. He resigned as Chief Engineer about eight years ago owing to failing sight. In addition to his duties with the Harbor Commission, he has carried out much important consulting work—notably a one-million-dollar pier for the Intercolonial Railway Terminals at Halifax. He has been retained many times by the Dominion Government. Mr. Kennedy, who was born at Prescott, Ont., is now in his seventy-seventh year, and it is just forty years since he went to Montreal as Chief Engineer of the Harbor Commission. Previously he had been Chief Engineer of the Great Western Railway of Canada, with headquarters at Hamilton.

Mainly Constructional

East and West From Coast to Coast

Sixteen men from the office of Messrs. Ross & Macdonald, architects, Montreal, have joined the Canadian contingents.

Edmund G. Cullen, dealer in builders' supplies and contractors' equipment, Vancouver, has assigned. The assignee is Ralph Donoghue, 509 Richards Street, Vancouver.

Messrs. R. S. and W. S. Lea, Consulting Engineers, Montreal, have been retained to report on plans prepared for sewerage and water supply systems for Bathurst, N.B.

An interesting paper on "Protective Coatings for Structural Steel" was read last week by Mr. George Henderson before the members of the Nova Scotia Society of Engineers.

Messrs. Patterson, Chandler & Stephen, Limited, stone merchants, marble workers and quarry men, have obtained a charter. The head office is at Vancouver, and the capital of the company is $25,000.

Exterior work is progressing rapidly on the new school which the Toronto Board of Education are erecting on Givens Street, at a cost of $165,000. The building, which is of brick construction, will contain thirty rooms.

A new company, whose head office will be at Ottawa, is the White Marble Company of Canada, Limited, which is capitalized at $150,000. The incorporators include Mr. T. A. Beament and Mr. A. H. Armstrong, both of Ottawa.

The Simplex Asphalt Paving Company, Limited, Montreal, has been incorporated with a capital of $100,000. The incorporators include Messrs. F. H. Markey, W. W. Skinner, W. G. Pugsley, G. G. Hyde, and R. C. Grant, all of Montreal.

Three aviation sheds are under construction at Toronto. The work is being carried out by the owner, Captain E. L. Janney. The building now being erected is 80 x 50 ft. in dimensions, of frame construction, with galvanized iron sides and roof.

Some of the smaller municipalities in the eastern provinces are doing their proportionate share of construction. Last week we noticed that St. Michel de Lavel, Que., awarded a contract for concrete pavement and asphalt sidewalks running into $130,000.

Mr. H. S. Van Scoyoc, Chief Engineer to the Toronto-Hamilton Highway Commission, is urging that all traffic between the two cities be diverted from the Lake Shore Road to the Dundas and middle roads, in order that constructional operations may proceed unhampered. Excavation work is in progress, with six gangs of men engaged at different points. Contracts have been let for material, and the force will be augmented shortly. Five hundred men are now employed. The total excavation to date is estimated at 58,000 cubic yards. The sum expended on labor in the winter months exceeded $40,000.

Manitoba Engines, Limited, a Brandon concern, have just obtained a contract for 15,000 shells, which represents an expenditure of $70,000. The firm is taking enterprising measures to cope with the business, and has installed new machinery to the value of over $10,000. The contract must be completed within six months.

The interior work is now in progress on the eleven-storey office building which the Excelsior Life Association are erecting on Adelaide Street, Toronto, at a cost of $500,000. The building, which is of terra-cotta and brick construction, will be described in an early issue of The Contract Record. The architect is Mr. E. J. Lennox, and the general contractors are the P. Lyall and Sons Construction Company.

As an instance of the activity brought about by war contracts, mention may be made of what is being done at the Record Foundry, Moncton, N.B. This concern is installing new machinery to the value of $40,000, and is making arrangements to double its staff in order to cope with the new business in hand and in prospect.

Mr. A. R. Wetmore, Chief Engineer of the Public Works Department of New Brunswick, paid a visit to St. John recently for the purpose of inspecting the suspension bridge work and making arrangements to carry it forward to completion as early as possible. The contractors for the substructure are the McVey Company of St, Stephen, while the Dominion Bridge Company have the contract for the superstructure.

The Alaska Railroad Commission have awarded to The Browning Company, Cleveland, a $6,000 contract for a locomotive crane. The company have shipped to Wheeling, W. Va., a twenty-ton locomotive crane to be used in Ohio River work. To the Panama Canal Commission they have sent a railroad pile-driver, which makes the third of its kind purchased at a cost of $14,000 each. They have furnished twenty-eight such cranes for use in Panama operations.

As one of the results of the orders for shells placed by the Government with Vancouver engineering firms, it is probable that The Heaps Engineering Company will be reorganized and resume active operations. The intimation was given in the Supreme Court last week when an application, which had been pending for some time by a creditor asking for the winding up of the company, came up for hearing. The company is now undergoing re-organization with every hope of success.

From New Westminster, B.C., comes word that the last pile in the North Arm jetty, under construction by The Marsh Hutton Powers Construction Company for the Dominion Government, was driven last week by the Fraser River Pile Driving Company, who had the piling contract on this undertaking. Another month will see the completion of the brush mattressing, which goes out further than the piling, while the rock facing, it is anticipated, will be finished in six weeks. Remarkable time has been made, partly owing to the unusually good weather which has been experienced during practically the entire time it was under way. The jetty, which is two miles long, was commenced in May last year, and under the present schedule it will be finished completely by the middle of June, or little more than thirteen months. Dredging is proceeding rapidly, but this will take probably another year to finish, as it was not started until six months after the building of the jetty began. The final completion of the undertaking will be of inestimable benefit to the North Arm, providing a navigable channel for vessels of considerable draught.

The end of this season will see the completion of $600,000 worth of work on good roads in York County, Ont., according to Mr. George S. Henry, at the meeting of the County Board of Highway Commissioners last week. Already the sum of $480,000 has been expended on the county highways since the inception of the work about three years ago. This year's programme, amounting to $120,000, will bring it up to the total of $600,000, the city, county and province each bearing an equal share of the cost. It was announced that seventy miles of the one hundred and fifteen miles of road in the county system had been rebuilt, and that another twenty-five miles was included in the recommendations of Mr. E. A. James for the year. Ten gangs of men will commence work shortly in various parts of the county. A start will probably be made on the reconstruction of Main Street, Weston, where one and three-quarter miles of new highway will be laid. Improvements will be effected on the following roads this season: Yonge Street, Markham, Kennedy, Don Mills, Lake Shore, Dundas, Weston, Malton, Vaughan and Kingston Roads.

The new international bridge spanning the St. John River between St. Leonards, N.B., and Van Buren, Maine, was opened on May 1st. The opening of the bridge is of great importance to the residents of New Brunswick and a portion of Quebec, as it forms the connecting link between the International branch of the Intercolonial Railway, the Canada and the Bangor and Aroostook Railway in Maine, thus giving direct connection between these districts for the first time. At the point where the bridge is built the St. John River is 970 feet wide and the bridge consists of five single track spans of 160 feet each, supported on the concrete tbuaments and four concrete piers. The bridge is of cantilever construction. A notable feature of the construction work is the rapidity of the completion, only seven and a half months having elapsed from start to finish. The principal contractors were Cyr Brothers, Waterville, for substructure; Dominion Bridge Company, Montreal, superstructure; Hill & Hammond, Woodstock, roadbed, tracklaying, etc., and the Central Railway Signal Company of Canada for the interlocking signals. Mr. W. J. Wilgus, of New York, was the consulting engineer, and Mr. T. A. Lang the resident engineer.

The Quebec Streams Commission, Montreal, have asked for tenders for the construction of a concrete storage dam on the St. Maurice River, 2½ miles above La Loutre rapids and 14 miles above the mouth of the Wabano River. The plans were prepared by Mr. J. W. Thurso, Mr. E. Wegmann, of New York, being called in as consulting engineer, and on his advice a plain gravity dam was adopted. Bearing in mind that the amount of water to be held back by this dam, 160,000,000 cubic feet of water, is just twice as great as the amount stored by the enlarged Assuan dam, which at present forms the largest reservoir in existence, and that the failure of this dam might mean a tremendous damage to the industries located along the St. Maurice river below this storage, besides causing probably a considerable loss of lofe, both Mr. Wegmann and Mr. Thurso agreed that a type of dam be chosen that has been thoroughly tested by many years of practical experience. The dam is to be 1,720 feet long, following a broken line formed of four straight lines intersecting at obtuse angles, with a measuring weir, made of reinforced concrete, 375 feet in length, with its abutments and wing walls. It was originally intended to erect a power house, but it has now been decided to omit this, and if necessary later to develop power at a fall lower down the St. Maurice River. Ten gates each 12 ft. high by 7 ft. 6 in. wide, capable of discharging 18,000 cubic feet of water per second, are to be placed in the dam, the gates to be operated by hand power. The spillway will be 865 feet and is extended to a log sluice.

The Tuec Stationary Cleaner

From Mr. James J. Martindale, Toronto, we have received an interesting illustrated booklet descriptive of the Tuec stationary cleaner. The strong points of the Tuec are enumerated as follows:

1. Simplicity—the greatest of engineering virtues.
2. The large volume of air handled at a vacuum—seemingly sufficient for all needs.
3. The elimination of all intermediate gearing, permitting of the direct connection of the motor and the fan.
4. The quietness of operation, due to the true rotary motion and absence of all reciprocating parts.
5. The compactness of the plant unit, necessitating a minimum of floor space and head room.
6. The fewness of the number of bearings requiring attention and the perfect disposition of the bearings for sustaining the loads to which they are subjected.
7. No metal surfaces in sliding contact—therefore no chance for cutting and wear.
8. The general excellence of the workmanship entering into the component parts of the machine.

Eager, Coombes & Company, Limited, is the new name of an old established Halifax builders' supply firm formerly known as The General Contractors' Supply Company. Both Mr. F. S. Coombes and Mr. R. F. Eager, the principals, have wide business connections, and represent some of the best Canadian and American firms in eastern Canada.

From the Metropolitan Paving Brick Company, Canton, Ohio, we have received a copy of the firm's latest descriptive catalogue. This is an informative, well illustrated publication which cannot fail to be of interest to municipal engineers and contractors. The manufacturing processes of Metropolitan paving brick are detailed carefully from the shale-bed to the road-bed. The manufacturers have a strong point in the fact that the United States Government specifications use their product as an accepted standard by which the quality of paving brick is judged.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Belleville, One.

Tenders will be received until 5 p.m., May 13th, by A. C. McFee, Chairman of the Public Works Committee, for the construction of sewers on Coleman, West Moira, West Bridge and Catharine Streets. Plans and specifications at office of Engineer J. W. Evans.

Brockville, Ont.

Prices are now being received by Engineer G. H. Dryson, Victoria Hall, on a steel intake pipe to extend 800 feet into the river.

Cornwall Township, Ont.

Tenders on the construction of a drain will be received until June 7th by John Mullin, Mille Roches, Clerk to Township Council. Estimated cost, $9,000.

Fernie, B.C.

The Town Council have started work by day labor on the construction of crushed rock roads. Approximate cost, $5,000. Clerk, A. J. Moffatt, Box 757.

Glencoe, Ont.

The Town Council contemplate laying cement sidewalks on a number of streets and repairing others. Clerk, George Wilson.

Hull, Que.

The Hull Electric Railway Company, Main Street, are about to lay macadam paving on various streets by day labor.

By-laws have been passed providing for the construction of sidewalks and pavements at an estimated cost of $60,000, and extensions to the waterworks system at a cost of $200,000. Waterworks extensions to include an eight million gallon turbine pump and the construction of an aqueduct. Engineer, J. A. Laforest.

Lachine, Que.

Sewers are being laid in the Summerlea district under the supervision of the City Engineer, for the Marcil Trust Company, 180 St. James Street, Montreal.

Leamington, Ont.

The Town Council contemplate laying an 8-inch watermain on Erie Street and making other extensions. Clerk, R. M. Selkirk.

McKillop Township, Ont.

The Township Council are about to construct a tile drain on the Town Line. Clerk, J. M. Govenlock, Winthrop, Ont.

McLennan, Alta.

The Edmonton, Dunvegan & B. C. Railway, Edmonton, may lay a pipe line to a nearby lake for a water supply.

Merritton, Ont.

The Municipal Council are about to construct macadamized and concrete roads by day labor. Clerk, Richard Clark, Merritton. Estimated cost, $10,000.

North Montreal, Que.

The Town Council are about to lay sewers and install a sewerage purification plant. Engineer, F. C. Laberge, 30 St. James Street, Montreal.

Peterboro, Ont.

The City Council have had plans drawn for laying an 8-inch watermain on Hunter and Water Streets, a 14-inch main on McDonnel Street and a 5-inch pipe on London and Donegal Streets. Engineer, R. H. Parsons.

The installation of an electrically operated auxiliary pumping plant is contemplated by the Board of Works. Chairman, W. Buller.

Port Colborne, Ont.

The Town Clerk, D. Alair, is receiving tenders on the construction of concrete sidewalks on Kent Street.

Sherbrooke, Que.

The City Council are about to start the construction of watermains by day labor. Requisite pipe is in stock. Approximate cost, $12,000.

Stamford Township, Ont.

Tenders will be received until May 13th by C. F. Munroe, Southend Post Office, Ont., for the construction of approximately eight thousand square yards of paving of various kinds on Lundy's Lane and Portage Road. Plans and specifications at office of Township Engineer, T. G. Gardner, Queen Street, Niagara Falls, Ont. Estimated cost, $12,000.

Toronto, Ont.

Tenders will be received until May 25th by the Board of Control, for the construction of Argyle Street storm overflow sewer, section number three. Plans at office of Works Department, City Hall.

Victoria, B.C.

The City Council are about to start work on the laying of concrete and asphalt pavements on Cowichan, Quamichan, Richmond and Bank Streets. Work to be done by day labor. Engineer, C. H. Rust.

Wallaceburg, Ont.

The construction of granolithic sidewalks on a number of streets has been authorized by the Town Council, and work will be started shortly. Clerk, H. E. Johnston, Wallaceburg.

Wingham, Ont.

The Town Council contemplate the construction of 4-inch granolithic sidewalks on John, Catherine and William Streets. Clerk, John F. Groves.

CONTRACTS AWARDED

Montreal, Que.

The City Commissioners have let the contract for the construction of main sewers in Edward Ward to A. Pion & Company, 1300 Papineau Avenue, and for the construction of West Broadway Sewer Outlet to Henault & Hefferman, 692 Church Street, Verdun.

Mount Forest, Ont.

The Town Council have let the contract for the construction of drains on Main Street to W. Hutchinson, Mount Forest, the contract for the supply of tile to F. Hunt, Holstein, and for grading to W. Henry, Mount Forest.

Sault-au-Recollet, Que.

The general contract for the construction of sewers and watermains has been by the Tonw Council to Bastien & Forest, Montreal.

St. Michel De Lavel, Que.

A contract has been let by the Town Council to A. Chagnon, 1216 DesErables Street, Montreal, for the construction of concrete pavement and asphalt sidewalks on concrete base. Approximate cost, $130,000.

Railroads, Bridges and Wharves

Goderich, Ont.

The Grand Trunk Railway Company are considering the construction of a bridge over the tracks at Maitland River Hill. Engineer, Charles Forrester, G. T. Rly. Offices, Stratford.

South Baymouth, Ont.

Tenders will be received until 4 p.m., June 1st, by the Secretary, Department of Public Works, Ottawa, for the construction of a wharf and warehouse at South Baymouth on Manitoulin Island in Township of Tehkummah, District of Algoma East Plans and specifications at offices of the District Engineer, Sault Ste. Marie, the Post Master, South Baymouth, and the Department, Ottawa. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Walkerton, Ont.

The erection of a steel and concrete bridge over the road at Walkerton Flour Mills is contemplated by the Town Council. Mayor, F. W. Lippert.

Willoughby Township, Ont

Tenders for the construction of three bridges will be received until noon, May 25th, by the Township Clerk, J. A. Plyley, Chippewa P. O.

CONTRACTS AWARDED

Arran Township, Ont.

The Township Council have let the contract for the construction of a concrete bridge to James Cole, Owen Sound, Ont.

Downie Township, Ont.

The general contract for the construction of a bridge has been let by the Township Council to James Hill, Mitchell, Ont.

Harwich Township, Ont.

The contract for concrete work in connection with the erection of a bridge has been let by the Township Council to A. S. Everitt, c/o G. W. Riseborough, Blenheim, Ont.

Portneuf, Ont.
The Municipality have awarded a contract for the construction of a bridge to Arthur Gauthier, Portneuf. Concrete and steel construction, reinforced concrete flooring. Approximate cost, $4,500.

St. John, N.B.
The sub-contract for reinforced concrete flooring in connection with the bridge to be built over the Reversing Falls for the Provincial Department of Public Works, Fredericton, has been let to A. R. C. Clark & Son, 51 Water Street.

Public Buildings, Churches and Schools

Chapel Island, N.S.
Tenders will be received until May 31st by the Secretary, Department of Indian Affairs, Ottawa, for the construction of a council house here. Plans and specifications at offices of A. J. Boyd, Indian Superintendent, River Bourgeois, Rev. R. L. McDonald, Indian Agent, St. Peters, Rev. W. A. McPherson, Johnstown, at Sydney P. O., and at the Department, Ottawa.

Forest, Ont.
The congregation of the Church of Christ contemplate alterations to the church and rectory and repairs to the heating system. Particulars from T. W. Taylor.

Guelph, Ont.
The Provincial Department of Public Works, Toronto, have commenced the erection of a dormitory here by day labor, under the supervision of S. A. Armstrong, Assistant Secretary, Parliament Buildings, Toronto. Brick construction. Estimated cost, $20,000.

Hartland, N.B.
The Anglican Congregation are considering the erection of a concrete or brick church. Secretary to the Building Committee, Rev. Nicolo Franchette.

Kingston, N.S.
Frank W. Graves, Architect, Aylesford, has prepared plans for a church to be erected here for the Baptist Congregation, at an estimated cost of $8,000. Work to be done by day labor under the supervision of Charles Welton, Tremont. Frame construction, concrete foundation.

Langley Prairie, B.C.
Tenders will be received until noon, May 15th, by E. Giffith, Deputy Minister of Public Works, Victoria, for the construction of a two-roomed school and outbuildings here. Plans and specifications at offices of F. C. Campbell, Government Agent, New Westminster, J. Mahoney, Court House, Vancouver, R. A. Payne, Secretary to the School Board, Murrayville, and at the Department, Victoria.

Muscowpching Reserve, Sask.
Tenders on the construction of an Indian house will be received until June 7th by the Secretary, Department of Indian Affairs, Ottawa. Plans and specifications at offices of H. Nichol, Indian Agent above reserve, W. Graham, Inspector of Indian Agencies, File Hills, at the Post Offices, Indian Head and Balcarres, and at the Department, Ottawa.

Montreal, Que.
Plans for a Public Bath to be built in St. Gabriel Ward are being prepared by Architect A. Chausse, City Hall. Tenders will be called for later.

Ottawa, Ont.
Sub tenders are now being received on painting, heating, plumbing, and electrical work in connection with the erection of a boarding school on Daly Street for Les Chanoinesses, Cinq Places, 383 Daly Street. General contractors, N. Poirier & Son, 193 Cathcart Street.

Otterville, Ont.
Electrical fixtures and interior furnishings for the new St. John's Church will be purchased by F. G. Bullock, Otterville.

Toronto, Ont.
The Board of Education will receive tenders until May 14th for the erection of an Administration Building on College Street. Brick and stone construction. Plans and specifications at office of the Superintendent of Buildings, City Hall. Approximate cost, $100,000.

Verdun, Que.
The Department of Public Works, Ottawa, contemplate the erection of a post office here at an approximate cost of $100,000. Tenders may be called shortly. Secretary, R. C. Desrochers, Ottawa.

Windsor, Ont.
The roofing, plastering and painting in connection with the church being built for the colored Baptist Congregation will be done by the general contractors, Lambert & Braithwaite. Electrical work not yet let.

CONTRACTS AWARDED

Berlin, Ont.
The general contract for the erection of a public library on Queen Street has been let to J. Baetz, and the interior fittings contract to Walker Bin & Store Fixture Company, 152 Shanley Street. The other work will be done by the general contractor. Approximate cost, $13,200.

Lac Aux Saumons, Que.
Work has been started on the completion of a convent here. General contract, carpentry and painting contracts have been let to Landry & Simard. Approximate cost, $4,700.

Napanee, Ont.
The heating contract in connection with the drill hall being erected here for the Department of Public Works, Ottawa, has been let to George Ross & Company, King Street, Brockville.

Ottawa, Ont.
The painting and decorating contract in connection with St. Lucas Church has been let to D. E. McPhee, 213 Waverley Street.

The general contract for the erection of St. Lucas Evangelist Church on MacKay Street, has been let to E. Wentzleff, 244 MacKay Avenue, and the contract for the seating to The Globe Furniture Company, Shantz Avenue, Waterloo, Ont. Estimated cost, $20,000.

Quebec, Que.
In connection with the drill hall being built here for the Department of Public Works, Ottawa, the contract for marble and tile work has been let to Smith Marble & Construction Company, 145 Van Horne Avenue, Montreal.

St. Sylvestre, Que.
The general contract for the erection of the Convent du Bon Pasture has been awarded to Levasseur & Fortier, Victoriaville, Que. Frame construction. Architect, J. W. Gregoire, 191a Wellington Street, Sherbrooke. Estimated cost, $10,000.

Wallaceburg, Ont.
The School Board have let the general contract for the erection of a school here to W. G. Shaw, Sarnia. Estimated cost, $20,000.

Business Buildings and Industrial Plants

Arranvale, Ont.
Plans of a grist mill are being prepared for Jno. McMullin, Arranvale, Tara Post Office. Owner will be in the market for machinery.

Belleville, One.
Work is about to start on the erection of a bank building on Front Street for the Dominion Realty Company, 34 King Street W., Toronto, under the supervision of E. Bennett. Material will be purchased locally.

Camden Township, Ont.
Harvey Rolston, R. R. No. 3, Dresden, contemplates the erection of fireproof farm buildings at an estimated cost of $4,000.

Elkhorn, Man.
Tenders will be received until June 7th by D. C. Scott, Department of Indian Affairs, Ottawa, for the construction of a barn and outbuildings here. Plans and specifications at the Post Office, Brandon, the Indian Office, Portage la Prairie, the Indian School, Elkhorn, and at the Department, Ottawa.

Fort William, Ont.
Work has been started by day labor on the erection of stores for J. C. Murray, Murray Block. Architect, H. M. Scott, c/o owner. Estimated cost, $25,000.

Hamilton, Ont.
Seymour & Walker, Bank of Hamilton Building, are about to erect a store at an approximate cost of $3,000. They will do masonry, carpentry, steel and roofing. Other trades not let.

Harrow, Ont.
Tenders for the erection of a store and lodge hall for the Oddfellows will be received until 8 p.m., May 17th, by Arthur Agla, Harrow. Plans and specifications at the office of Thomas Jenner, Kingsville. Hollow tile, concrete block and pressed brick construction. Approximate cost, $8,000.

Kingsville, Ont.
The tobacco barns of Everett Wigle, Kingsville P. O., which were recently destroyed by fire, will be replaced by a fireproof structure. Estimated cost, $5,000.

Kintore, Ont.
James E. Caldwell, Reeve of East Nissouri Township, contemplates the erection of a barn and stable. Steel truss and frame construction, corrugated iron roofing.

McLennan, Alta.
The enlargement of the local hotel is contemplated by Messrs. Giroux and Hamel.

Montreal, Que.
Joseph Ward, 115 Youville Square, is considering repairs to his store at 458 St. Paul Street, which was recently damaged by fire. Work is mostly carpentry,

glazing and electric wiring. Estimated cost, $4,000.

Plans are being prepared by A. Chausse, City Hall, for a garage to be erected at Clark and Loganchetiere Streets for the City Council.

N. Martineau, 1231 Lajoie Street, is about to commence the erection of stores and apartments. Estimated cost, $6,000.

Moose Jaw, Sask.
Work will be started at once on remodelling a store at Main and River Streets for the F. W. Woolworth Company. Canadian Manager, R. Connable, Queen and Yonge Streets, Toronto.

Mount Brydges, Ont.
The Wallace Sawmill Company contemplate rebuilding their plant, which was recently destroyed by fire, and purchasing new machinery.

North Gosfield Township, Ont.
Charles Barrett, Concession 7, Essex Post Office, contemplates rebuilding his farm buildings, recently destroyed by fire.

Ottawa, Ont.
L. N. Poulin, Limited, 156 Sparks Streeta, are now receiving bulk or separate tenders for alterations to their premises. Approximate cost, $17,000.

Tenders for an addition to the garage at McLaren and Cartier Streets are being received by Horwood, Taylor & Horwood, 130 Sparks Strete. Brick construction, concrete foundation, shingle roofing.

Pelee Island, Ont.
Stanley McCormick has commenced the erection of a summer hotel. Frame construction, shingle roofing. Estimated cost, $5,000.

Quebec, Que.
Tenders will be received until May 14th by the Canadian Pacific Railway, Engineering Department, for the erection of a central station ot St. Paul and Henderson Streets, at an approximate cost of $1,000,000. Construction, granite, firebrick, terra-cotta, steel, concrete foundation on concrete piles, and marble facing. Specifications for plumbing heating, ventilating and electrical work will be ready in about two weeks. A separate contract will be let for the erection of a power house and the installation of boilers, etc., and tenders for this work will be called later. Architect, H. E. Prindle, 915 New Birks Building, Montreal.

Ridgetown, Ont.
The Ridgetown Milling Company contemplate rebuilding their mill, which was recently destroyed by fire with a loss of $30,000. Manager, A. S. Blight.

Seaforth, Ont.
Work will start shortly on decoration and interior alterations to the store of Beattie Bros.

St. Thomas, Ont.
J. W. Chantler, 325 Talbot Street, is about to remodel premises which he has purchased.

Strathroy, Ont.
Charles Giffen, Main Road, Adelaide Township, Strathroy P. O., is considering the erection of fireproof stock buildings, at an approximate cost of $4,000.

George Rivers, Arkona, Ont., is considering the erection of a basket factory, at an estimated cost of $6,000.

Sydney, N.S.
H. P. Burns, Victoria Road, is considering the rebuilding of his premises, which were recently destroyed by fire, with a loss of $7,000.

Sydney Mines, N.S.
M. N. McRae has commenced the construction of a theatre, at an estimated cost of $8,000. Frame construction, ruberoid roofing.

Tara, Ont.
Plans for an office building are being prepared by A. Wain. Concrete block construction. Estimated cost, $5,000.

Tuckersmith Township, Ont.
Dougald Fotheringham, Brucefield, Ont., contemplates rebuilding his stock building, which was recently destroyed by fire.

Underwood, Ont.
Plans of a store are being prepared for Thede & Brill. Frame and brick construction, felt and rgavel roofing. Approximate cost, $4,000.

Verdun, Que.
Plans have been drawn for a store and residence to be built on Wellington Street by F. Fluigan, 385 LaSalle Road, at an estimated cost of $6,000. Brick construction, concrete foundation.

Victoria Harbor, Ont.
James Hawthorne, Vasey Post Office, is considering the erection of a barn. Concrete construction.

Wallaceburg, Ont.
James Bobier contemplates rebuilding his barn, which was recently destroyed by fire. Fireproof construction.

Winnipeg, Man.
The Western Mausoleum Company, 512 Boyd Building, have secured a site for their projected mausoleum, in Riverside Cemetery. Reinforced concrete construction, stone facing, crypts faced with marble. Work to be done by day labor.

CONTRACTS AWARDED

Berlin, Ont.
The general contract for the erection of an addition to bakery on Scott Street for H. A. Deitich, King Street East, has been let to C. Braun. Interior fittings contract not awarded. Estimated cost, $7,000.

Hamilton, Ont.
In connection with the erection of a factory on Burlington Street for Proctor & Gamble Company, Ivorydale, Ohio, the steel contract has been let to the Hamilton Bridge Works, Bay Street, and the roofing contract to John E. Riddle & Company, 14 Ferguson Avenue N. Heating, plumbing and electrical work will be done by owners.

James H. Stewart, Jackson and Hughson Streets, has let the following contracts in connection with the erection of a garage on Hughson Street S: steel, Hamilton Steel Construction Company, Lottridge Street; roofing, C. Drew, 173 King William Street; electrical work, Electric Supply Company, 65 James Street S. Heating and plumbing will be done by owners.

In connection with alterations to the factory of The National Paper Goods Company, Queen Street W., the general contract, masonry and carpentry contracts have been let to W. H. Yates, 24 Leeming Street. Approximate cost, $7,500.

London, Ont.
The general contract for the erection of a grand stand has been let by Western Fair Association to McGregor & McIntyre, Limited, 1139 Shaw Street, Toronto, and the wrecking contract to John Hayman & Sons Company, Limited, 432 Wellington Street. Steel construction. Approximate cost, $29,000.

McLeod, Alta.
The McLeod Flour Mills, Limited, have let the general contract for the erection of a flour mill here to F. W McDougall, 321 Eighth Avenue N., Calgary. Approximate cost, $9,300.

Montreal, Que.
The contract for alterations to the premises of the Gem Lunch Company, 202 St. James Street, has been let to the Smith Marble & Construction Company, 145 Van Horne Avenue.

The general contract for the construction of a grand stand at Atwater and St. Catherine Streets for the Montreal Baseball Club Company, 173 Common Street, has been let to T. S. Hudson & Company, Board of Trade Building, at $4,300.

Norwich, Ont.
The contract for the installation of an elevator in the cold storage building of the Borden Milk Compny, Main Street, has been let to the Otis-Fensom Elevator Company, Victoria Avenue N., Hamilton.

Ottawa, Ont.
The general contract for alterations to a store for L. N. Poulin, Limited, 156 Sparks Street, has been let to Taylor & Lackey, 21 First Avenue. Approximate cost, $17,000.

The eectrical contract in connection with the stores and apartments being erected on Elgin Strete for S. W. Halliday, 20 Arlington Street, has been let to E. G. Tressider, 58 Fifth Avenue. Plastering and painting contracts not let.

The following contracts have been let in connection with the erection of a store for C. D. Joyce, 1102 Somerset Street: brickwork, J. Copeland, 19 Laurel Street; heating, J. Cameron, 488 Lewis Street; electrical work, H. L. Allan, 377 Somerset Street; lumber and interior fittings, McAuliffe-Davis Company, Duke Street. Plastering, painting and plumbing not let. Brick supplied by Russell Schole Brick Company.

Cowie & Moore, 202 First Avenue, have let the contract for electrical work at their machine shop on Bank Street to J. A. Ellacott, 226 Bank Street.

Peace River Crossing, Alta.
R. W. Gibbs has let the general contract for the erection of an hotel to F. Bennett. Concrete foundation, frame construction, shingle roofing.

Quebec, Que.
J. B. Renaud & Company, Paul Street, have let the general contract and carpentry contract for the erection of a warehouse on Rioux Street to L. D. Vezina, 156 St. Patrick Street, and the masonry contract to Emile Cote, 360 Richelieu Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $17,000.

Sherbrooke, Que.
The Sherbrooke Construction Com-

pany, St. Francis Street, have commenc~~ed the~~ erection of a machine shop for McKinnon Halmes & Company, Drummond Road. Steel work and heating are being done by owners.

St. Malo, Que.

The Transcontinental Railway Commissioners have let the general contract for the erection of a construction shop here to J. Gosselin, Levis. Brick and steel construction.

Sussex, N.B.

In connection with the stores being built on Broad Street for George W. Fowler, Court Street, the sub-contract for tile work has been awarded to Nonneman Tiling Company, 254 Union Street, St. John.

Toronto, Ont.

The plastering contract in connection with the store and residence being erected on Danforth Avenue for Rossiter Bros., 1024 Queen Street E., has been let to White Bros., 57 Hunter Street.

A store and residence is being erected at Bloor and Ruunymede Streets for W. Hart by Davis & Moore, 176 St. Calrens Avenue, at an estimated cost of $4,000. Brick construction, stone foundation, felt and gravel roofing

The P. Lyall & Sons Construction Company are now doing the interior work at the Excelsior Life Building, 47 Adelaide Street E

The masonry work in connection with alterations to the store at 211 Yonge Street is being done by J. E. Almond, 78 Constance Street, and the carpentry work by J. Corless, 490 Manning Avenue.

Residences

Alliston, Ont.

William Knight has commenced the erection of ten dwellings, to cost between $2,500 and $4,000 each. Brick construction, shingle roofing.

Work has been started by H. Garbutt on the erection of two houses. Four others will be built this summer, costing between $2,500 and $4,000 each. Brick construction, shingle roofing.

Blenheim, Ont.

W. Grant, Ridge Road West, has commenced the construction of a residence, estimated to cost $3,000. Frame and brick construction, shingle roofing.

Cedar Springs, Ont.

George Senitte contemplates the erection of a residence.

Charlottetown, P.E.I.

Plans have been drawn for a residence to be erected for R. E. Spillett, 116 Cumberland Street. Frame construction, brick foundation, shingle roofing. Estimated cost, $4,000.

Cottam, Ont.

Plans for a frame residence are being prepared by Ernest Queen. Estimated cost, $3,000.

Durham, Ont.

H. Truax, Walkerton, Ont., is preparing plans of a residence to be erected here for Guy Kearney. Estimated cost, $3,500.

Flesherton, Ont.

Work has been commenced by day labor on the erection of a residence and garage for Dr. F. T. Bibby. Brick construction, stone foundation, shingle roofing. Estimated cost, $7,000.

Fingal, Ont.

J. Lethbridge, South Road, will rebuild his residence recently destroyed by fire. Estimated cost, $3,500.

Galt, Ont.

Tenders will be called shortly for the erection of a residence at Brant and Aberdeen Streets for J. R. Blake, Gilholm Avenue, at an approximate cost of $6,000. Brick construction, stone foundation, shingle roofing. Architect, W. Evans, Water Street North.

Hamilton, Ont.

Work on the erection of a residence is about to be started by Crompton & Crompton, Bank of Hamilton Building. Frame construction, concrete foundation, shingle roofing. Estimated cost, $5,400.

Plans have been drawn for a residence to be erected on Summerset Avenue by Deeley & Dodgson, 50 Barnsdale Avenue. Owners will do masonry, carpentry, steel and roofing. Other trades not let. Estimated cost, $3,000.

Hampton, P.E.I.

Lewis J. Taylor contemplates the erection of a residence.

Hespeler, Ont.

Thomas Chesterton is considering the erection of a residence.

Huffmans, Ont.

Georfe Huffman, R. R. No. 5, Blenheim, Ont., is about to start work on a residence. Frame and brick construction, shingle roofing. Approximate cost, $3,000.

Midland, Ont.

Thomas Williams, Midland P. O., is considering the erection of a brick farm residence at a cost of $5,000.

Montreal, Que.

H. Couture, 958 Mentana Street, is considering the erection of three flats at 964-968 Mentana Street. Estimated cost, $3,500.

Plans have been drawn for a residence to be built on Notre Dame de Grace Ave. for C. D. Peloquin, 448 Old Orchard St. Estimated cost, $3,500.

F. R. Foster, 3 Beaver Hall Square, has prepared plans for three residences to be erected on Marcil Avenue by Roberts & Pick, 112 Addington Avenue, at an estimated cost of $9,000.

Leon Deslauriers, 496 Fabre Street, has had plans drawn for two flats to be built on Garnier Street. Approximate cost, $6,000.

Tenders are now being received by A. Chausse, Architect, City Hall, for repairs to the residence at the pumping station. Estimated cost, $10,000.

A permit has been issued to Laflamme & Bedford, 3137 St. James Street, for a residence to be erected on Melrose Ave. Estimated cost, $8,000.

D. Dufresne, 427 Third Avenue, Rosemount, has had plans drawn for a residence to be built on Durocher Street, at an estimated cost of $5,000.

Work is about to start on the erection of a residence at Fabre and Laurier Streets by A. & D. Boileau, 1485 St. Andre Street. Approximate cost, $25,000.

Plans have been prepared for two residences to be built by A. Cloutier, 810 Durocher Street, Outremont, at an estimated cost of $13,000. Concrete foundation, brick construction, felt and gravel roofing.

J. C. Rancourt, 115 Melrose Avenue, is about to erect a residence on Old Orchard Street at an estimated cost of $12,500. Work by day labor.

A. S. Ulley is considering the erection of an addition to his residence at 80 Ste. Famille Street. Concrete foundation, stone construction, felt and gravel roofing. Estimated cost, $4,000.

Napanee, Ont.

A. E. Allaster, 42 King Street East, Brockville, is preparing plans for a residence estimated to cost $3,000. Frame and brick construction, stone foundation. Owner's name withheld.

North Bay, Ont.

G. W. Duncan, Oak Avenue, is having plans of a residence prepared by Angus & Angus, Angus Block. Brick construction, stone foundation, shingle roofing. Estimated cost, $4,000.

Plans for a residence to be erected on Cassels Street for W. Aubrey are being prepared by Angus & Angus, Angus Block. Indiana stone and brick veneer construction, shingle roofing. Approximate cost, $4,000.

Ottawa, Ont.

Prices on the erection of a residence on Bellwood Street are being received by W. J. Spratt, Sunnyside Avenue, manager of The Oakland Lane Company, c/o C. C. Ray & Company, Sparks Street. Stucco and brick construction. Estimated cost, $7,000.

Alfred McDonald, 84 Fulton Street, has commenced the erection of a residence on Bronson Street. Frame construction. Estimated cost, $3,000.

Plans of a residence have been drawn for W. H. Craig, 136 Bank Street. Stucco and brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,600.

The erection of a large apartment house on Slater Street is contemplated by the H. N. Bate Realty Company, Canal Street.

Prices are being received by N. Poirier & Son, 193 Cathcart Street, on painting, heating, plumbing and electrical work required in the erection of tenements on York Street.

T. J. Somerville, 28 Waverly Street, is having plans drawn for a brick veneer residence to be built on Frank Street, at an estimated cost of $5,500.

The roofing, plastering, painting, heating, plumbing and electrical work in connection with the residence being built for Calib Brooks, Driveway West, will be done by day labor under supervision of the owner. Prices are now received on interior fittings.

In connection with the erection of a double residence in Ottawa South for B. A. Grison, 100 Fentiman Street, the owner will do carpentry and make cement blocks. Other work will be sublet

Port Rowan, Ont.

W, P. Hathaway is about to prepare plans for a residence estimated to cost $3,000. Material not yet purchased.

A. F. Price is preparing plans for a residence, estimated to cost $3,000.

Plans of a residence are being prepared by Frank Mason, West End Lighthouse. Frame and brick construction, shingle roofing. Approximate cost, $3,000.

Quebec, Que.
The masonry and carpentry work in connection with the residence being built on St. Foye Road for J. J. Brophy will be done by day labor. Material will be purchased by owner.

Work has been started on the erection of a residence on Fifth Street, Limoilou, by C. A. Bourret, 259 Queen Street. Brick and frame construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,000.

W. Lapointe, 226 Marie de L'Incarnation Street, has commenced the erection of a residence at an estimated cost of $5,000. Brick and frame construction, metal roofing.

A brick residence is being erected by O. Nolin, 113 Stigmates Street. Estimated cost, $6,000.

Jos. Cauchon, 364 Richelieu Street, has commenced the erection of a brick residence on Stigmates Street. Estimated cost, $4,000.

Ravenswood, Ont.
Plans of a frame and brick dwelling are being drawn by John Ross. Estimated cost, $3,000.

Sherbrooke, Que.
Tenders are being received on the erection of a residence at 27 Quebec Street for A. R. B. Lockhart, 42 Montreal St. Estimated cost, $5,000. Architect, H. G. James, Whiting Block.

Skipness, Ont.
Plans of a brick residence are being prepared for Robert Warmington. Estimated cost, $3,000.

St. Marys, Ont.
Joseph Rea is preparing plans for a residence to cost about $3,200. Brick construction, stone foundation, shingle roofing.

Plans of a residence are being prepared by Keith Lee. Frame construction, concrete foundation, shingle roofing. Estimated cost, $3,000.

W. Pullyblank, Queen Street, is preparing plans for a residence to be erected on Jones Street, at an estimated cost of $3,200. Frame construction, concrete foundation, shingle roofing.

Strathroy, Ont.
George Brock is preparing plans for a brick residence to cost about $3,500.

Toronto, Ont.
The Elias Rogers Company, 28 King Street West, have had plans drawn for a residence and stable to be erected on Poucher Street under the supervision of T. Barber. Brick construction, felt and gravel roofing. Estimated cost, $6,500.

Forde & McCurrah, 125 Rainsford Road, are building a residence on Columbine Avenue, at an estimated cost of $4,500. Smaller trades may be sublet.

Tenders on plumbing and heating required in the erection of a residence will be received by W. J. Nixon, 32 Columbine Avenue. Estimated cost, $4,000.

W. J. Deeth, 129 High Park Avenue, is about to start work on the erection of a residence on Glencairn Street by day labor. Estimated cost, $5,500.

Tenders will be called for shortly on the erection of a residence at Balmy Beach for W. M. Miskelly, 174 Victor Avenue. Frame and brick construction, shingle roofing. Approximate cost, $4,700. Architect, W. Breden Galbraith, 22 St. Leonards Avenue.

Tenders will be received until May 13th by the Toronto Hydro-Electric Commissioners, 226 Yonge Street, for the removal of houes, etc., at 31-41 Nelson Street. Particulars at office of Purchasing Agent, 15 Wilton Avenue.

E. M. Brett, 39 Rainsford Road, has commenced the erection of a residence on Willow Street. Brick construction, shingle roofing. Estimated cost, $3,500. Smaller trades may be sublet.

Plans have been drawn for a pair of residences to be built on Sellers Avenue by T. J. Maybee, ,85 Sellers Avenue. Brick construction, shingle, felt and gravel roofing. Approximate cost, $3,500.

Verdun, Que.
A. Maloit, 380 Gertrude Street, has commenced the erection of three flats on Wellington Street. Brick construction, concrete foundation. Estimated cost, $4,000.

Victoria Harbor, Ont.
Charles Beattie, Vasey Post Office, contemplates the erection of a farm residence at an estimated cost of $3,000. Brick construction, concrete foundation.

Walkerton, Ont.
A. Waas, Cayley and Jackson Streets, is about to build a residence at an estimated cost of $4,000. He will do masonry and plastering himself.

Thomas Pellow is razing an old building preparatory to the erection of a residence. Estimated cost, $3,000.

West Lorne, Ont.
D. M. Leitch is preparing plans of a residence to be erected on Graham St. Frame and brick construction, shingle roofing. Approximate cost, $3,000.

Wheatley, Ont.
James Wigfield will rebuild his residence, which was recently destroyed by fire. Estimated cost, $3,500.

Windsor, Ont.
W. Hamburg has commenced the erection of a residence on Langlois Street at an estimated cost of $3,500. Brick veneer construction, concrete foundation, shingle roofing.

CONTRACTS AWARDED

Barrie, Ont.
The masonry contract in connection with the residence being erected by W. C. Thompson has been awarded to Thomas Tooke.

Bridgeburg, Ont.
The contract for masonry in connection with the residence being built on Highland Avenue by Charles Anger, has been let to A. Osborne, and the carpentry contract to M. Beam. Estimated cost, $5,000.

Charlottetown, P.E.I.
J. Anderson, 206 Hillsboro Street, has let the general contract for the erection of a residence on Richmond Street to M. Schurman, Church Street, Summerside. Frame construction, brick foundation, shingle roofing. Estimated cost, $4,000.

Edmonton, Alta.
J. R. McIntyre is erecting an addition to the residence of P. Abbott, 1245-25th Street, at an estimated cost of $4,000. Frame construction, shingle roofing. Architects, Magoon & MacDonald, Tegler Block.

Guelph, Ont.
Taylor & Gratton have commenced the erection of a residence for W. W. Buchanan, Waterloo Road. Stone and brick construction. Approximate cost, $5,000.

Halifax, N.S.
The general contract for the erection of a residence at Sebastian and Gottinger Streets for Annie Evans, 10 Richmond Street, has been let to J. W. Evans, 10 Richmond Street. Estimated cost, $3,000. Frame construction, felt and gravel roofing.

The following contracts have been let in connection with the erection of flats on Jubilee Road for A. T. Smith, 108 Creighton Street : — general contract, Maxner & Dunlop, 150 Windsor Street; heating, Longard Bros., Hollis Street; plumbing, W. S. Craig, Upper Water Street; electrical work, Farquhar Bros., Barrington Street. All other work will be done by the general contractors.

Hamilton, Ont.
The masonry contract in connection with the erection of a residence at 93 Duke Street for F. Taylor, 55 Bay Street, has been let to J. Schuart, Locke Street S. Owner will do carpentry and roofing. Other trades not let.

Hensall, Ont.
Mark Drysdale has let the contract for the construction of a brick bungalow to Alfred Taylor, Hensall. Approximate cost, $4,000.

Hespeler, Ont.
Harvey Jones has awarded the general contract and masonry contract for the erection of a residence to W. Guenther, and the carpentry contract to Prestien & Bartles. Brick construction, stone foundation.

Ingersoll, Ont.
The general contract and carpentry contract in connection with the erection of a residence on Oxford Street for James Mabery have been let to Robert Layton, and the roofing contract to F. McKay. Other trades not yet let.

London, Ont.
E. H. Cowan, Wellington Street, has awarded the general contract for the erection of a residence to J. Putherbough, 1006 Wellington Street. Smaller trades will be sublet later. Estimated cost, $3,400.

Middleton, N.S.
O. A. Parker, Wakefield, Mass., or Middleton, has let the general contract for the erection of a residence to N. S. Wood, 27 Williard Street, Chelsea, Mass. Approximate cost, $15,000.

Montreal Que.
Leguerrier & Baillargeon, 305 Fourth Avenue, Rosement, have let the contract for the erection of eight flats on Fourth Avenue to J. Lapointe, 1420 Messier Street. Estimated cost, $8,000.

In connection with the residence being erected on Oxford Avenue for W. A. McQuestin, 46 Alexander Street, the plastering contract has been let to F. A. Sims, 454 Madison Avenue, and the painting contract to A. Craig, 41 Jurors Street.

Ottawa, Ont.
The general contract for the erection of a residence for Cyrille Pothier, 37

Cathcart Street, has been let to N. Poirier & Son, 193 Cathcare Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,000.

The general contract for the erection of a residence on Bethany Street for R. S. Bradley has been let to Thomas A. Shore, 6 Craig Street. Brick veneer construction, stone foundation, felt and gravel roofing. Approximate cost, $3,500.

The contract for brick and masonry work in connection with alterations to a residence for J. Knechel, 585 MacLaren Street, has been let to R. Beattie, 7 Renfrew Street. Brick veneer construction, stone foundation, felt and gravel roofing. Estimated cost, $3,000.

Quebec, Que.

L. D. Morin, 111 Mountain Hill, has let the general contract, masonry and carpentry contracts for the erection of a residence to L. A. Robitaille, 96 Marie de L'Incarnation Street. Artificial stone construction, felt and gravel roofing. Approximate cost, $8,000.

A. Deslauriers, 400 St. Francis Street, has commenced the construction of a residence on Daulac Street for Elzear Pouliot, 7 Daulac Street. Brick and frame construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

Work has been started on the erection of a dwelling for Louis Rochon, 80 Cremazie Street, by E. Rochette, 715 Stigmates Street. Brick and frame construction, concrete foundation, metal and asbestos roofing. Approximate cost, $3,000.

A. Marcotte, 33 Scott Street, has let a contract for repairs to a residence on Henderson Street to Joseph Breton, 175 St. Oliver Street. Estimated cost, $3,000.

The general contract and masonry contract in connection with the erection of a residence for F. Parent, Lamontagne Ave., Domaine Lairet, have been let to E. Cauchon, Lamontagne Avenue, Domaine Lairet. Frame and brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $3,000.

The general contract, masonry and carpentry contract in connection with the erection of a residence for Joseph Poulin, 160 Hermine Street, have been let to C. Jobin, 168 Latourelle Street. Frame and brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $5,000.

Joseph Robert has let the general contract for the erection of a residence to L. A. Robitaille, 96 Marie de L'Incarnation Street. Artificial stone construction, concrete foundation, felt and gravel roofing. Approximate cost, $6,000.

David Lacombe, 51 St. Malo St., has awarded the general contract for the erection of a residence to Poulin & Marcoux, 156 Latourelle Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $5,000.

Randolf, N.B.

W. J. Donnells is erecting a residence for E. P. Baker, Randolf, at an approximate cost of $7,500. Limestone construction, concrete foundation.

Renfrew, Ont.

J. L. Murray has let the general contract for the construction of a brick veneer residence to J. O'Brien. Approximate cost, $10,000.

Sarnia, Ont.

In connection with the erection of three residences on London Road for Harry J. Neal, London Road, the general contract, masonry, carpentry and roofing contracts have been let to A. McColman, 120 Nutton Street N. Frame construction, concrete foundation, shingle roofing. Estimated cost, $6,200.

St. Lambert, Que.

The contract for the construction of a residence on Logan Street for John Smith has been let to J. K. Duncan, Notre Dame Street. Brick veneer construction, concrete foundation, felt and gravel roofing. Approximate cost, $3,800.

St. Marys, Ont.

S. M. Tevlin, Widder Street, has awarded the general contract for the erection of a residence to Stafford & Henderson, Queen Street, and the masonry contract to W. Huether.

Toronto, Ont.

In connection with the residence being erected on East Lyne Avenue for W. J. Wingrove, 1973 Queen Street E., the masonry contract has been let to E. M. Morris, 38 West Lyne Avenue, and the carpentry contract to W. Goldsmith, 25 Coleridge Avenue.

S. M. Jackson, 323 Beech Avenue, has let the general contract for the erection of a residence at Bracken and Bingham Streets to H. B. Jackson, 323 Beech Ave. Brick construction, shingle roofing. Estimated cost, $5,000.

Marion W. Hill, 619 Parliament Street, has let the general contract for the erection of a residence on Bracondale Hill Road to J. W. Gratton, 486 Clinton St. Brick construction, shingle roofing. Approximate cost, $4,200.

Work has been started on the erection of a residence at 100 Stibbard Avenue for J. Parsons, by Angus Gillies, 548 Dovercourt Road. Smaller trades will be sublet. Estimated cost, $5,000.

The masonry contract in connection with the erection of a duplex house on Summerhill Avenue for J. A. Moss, 78 Grenadier Road, has been let to J. Hicks, 144 Montrose Avenue. Prices for smaller trades have been received, but contracts not yet let. Approximate cost, $7,000.

Uxbridge, Ont.

The contract for the erection of four dwellings for Moore Bros., hardware merchants, has been awarded to J. A. Orton, Orillia, Ont. Brick veneer construction, shingle roofing. Approximate cost, $12,000.

Westmount, Que.

The heating and plumbing contracts in connection with the erection of a residence on Edgehill Avenue for C. W. Tingling, 456 Mackay St., have been let to John Colford, 456 Guy Street. Roofing, tiling and electrical work will be let shortly. Approximate cost, $21,000.

The roofing contract in connection with the residence being built on Wood Avenue for H. R. Popham, 384 Wood Avenue, has been let to J. Dunphy, 55 Barrie Street, and the contract for tile, mantels and fireplaces to R. S. Muir & Company, 32 Park Avenue.

Windsor, Ont.

The general contract for the erection of a dwelling has been let by Frank Hogan, 280 Bruce Street, to W. Hendrick. Brick construction, concrete foundation, shingle roofing. Approximate cost, $3,500.

Power Plants, Electricity and Telephones

Ottawa, Ont.

The Ottawa Improvement Commission, 110 Wellington Street, are about to start work on a street lighting system. Concrete posts will be made and installed by day labor. Engineer, Alex. Stuart.

CONTRACTS AWARDED

Qu'Appelle, Sask.

The Lone Corner Rural Telephone Company have let the contract for the construction of a telephone system here to G. T. Brander, 208 Armour Block, Regina. Estimated cost, $3,000.

Sydney, N.S.

Stores and warehouses owned by E. J. Mitchell, Bridgeport, and Charles Mitchell, Sydney, and the Minto Hotel, owned by Mrs. T. Atkinson, have been destroyed by fire. Owners may rebuild.

Thamesville, Ont.

A by-law for the installation of Hydro power will be submitted to the ratepayers on May 10th. Town Clerk, W. J. Crydermam.

Fires

Granville, N.S.

A barn and residence belonging to Fred Strong, Upper Granville, has been destroyed by fire, with a loss of $4,000. Insurance, $1,500.

Hamilton, Ont.

Fire has damaged the residence of Benjamin Kay, 25 Agnes Street. The loss is partially insured.

Havelock, Ont.

A frame ice house belonging to the Canadian Pacific Railway Company has been destroyed by fire.

Hull, Que.

The lumber yard and sheds of H. Dupius & Son have been destroyed by fire with a loss of $8,000, covered by insurance.

The residence of Napoleon Poulin, Charron Street, has been destroyed by fire. Mr. Poulin will rebuild.

Killaloe, Ont.

A disastrous fire has destroyed the premises of J. Stack, Anthony Cybulski, Hazelton & Boland, J. Paulbetski and Thomas Cybulski. The loss of approximately $100,000 is covered by insurance to the extent of about 25 per cent. only.

Lajord, Sask.

The Imperial Lumber Yards have been damaged by fire to the extent of $5,000. Partially insured.

Lambeth, Ont.

W. F. Robinson's factory and the machinery therein have been totally destroyed by fire. Loss, $3,500.

Lennoxville, Que.

Howard Dundin's residence, Warren Street, has been destroyed by fire. Loss $3,000, partially covered by insurance.

Lucknow, Ont.

The frame building occupied by Wil-

(Continued on page 55)

Tenders and For Sale Department

Concrete Bridges

COUNTY OF WELLINGTON

Sealed tenders will be received for building ten reinforced concrete bridges of from 18 ft. to 30 ft. spans. Six to be let at Fergus on May 20th, and four at Mount Forest on May 21st. For plans, specifications, and other information, apply to James Boattie, county clerk, Fergus; W. A. Burnett, Elora; J. Campbell, Mount Forest; A. M. Reid, Kenilworth; or to

BOWMAN & CONNOR,
31 Queen Street West, Toronto.
19

Tenders for Sewer Construction

Sealed tenders plainly marked as to contents will be received by the undersigned up to **noon of Monday, May 17th, 1915**, for the construction of a sewer on Humewood Avenue, in the Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, May 5th, 1915
19

Department of Railways and Canals, Canada

Hudson Bay Railway Terminals

Port Nelson, Man.

Sealed tenders, endorsed "Tender for Provisions," will be received by the undersigned, up to **12 o'clock noon on Wednesday, May 19th, 1915**, for the furnishing of the above, to be delivered in such quantities at Halifax, N.S., and at such times as may be directed.

Dealers may tender for the total quantities required, or for such portions thereof, as may suit their convenience.

Specifications of requirements, and full information can be obtained from the Purchasing Agent of the Department of Railways and Canals, Ottawa, on and after this date.

An accepted bank cheque for $1,000, made payable to the order of the Minister of Railways and Canals must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for supplying any of the goods awarded to him, or in any way fails to properly fulfill the same.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The lowest or any tender not necessarily accepted.

By order,
J. W. PUGSLEY,
Secretary.

Department of Railways and Canals,
Ottawa, May 3rd, 1915.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—79479.
19

Road Machinery

Large U. S. firm making a special line of road drags desires to secure sales representatives in both Eastern and Western Canada who have good connections with municipalities and public contractors. Apply, Box 201, Contract Record & Engineering Review, Toronto.
19-21

Tenders for Auxiliary Pumping Unit

Sealed tenders, endorsed "Tender for Pumping Unit," addressed to S. R. Armstrong, Esq., Secretary, Peterborough Utilities Commission, Peterborough, Ont., will be received until **noon of May 31st, 1915**, for the construction and installation in place of a complete Pumping Unit.

Tenders must be accompanied by a marked cheque as required by Specification.

Specifications may be obtained from the Secretary; address as above.

WM. KENNEDY, Jr.,
Engineer,
19-20
364 University Street, Montreal.

Tenders for Dredging

Sealed tenders addressed to the undersigned, and endorsed "Tender for Dredging, Toronto, Ont.," will be received until 4 p.m., **Thursday, May 20, 1915**, for dredging required at Toronto, Eastern Gap.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work.

The Dredges and other plant which are intended to be employed on this work shall have been duly registered in Canada at the time of the filing of this tender with the Department, or shall have been built in Canada after the filing of the tender.

Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honorable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, but no cheque to be for less than fifteen hundred dollars, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

Th Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, May 3, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department 79498
19

CITY OF STRATFORD

Sealed tenders, marked "Tenders for Sewer Pipe," will be received by the undersigned up to five o'clock p.m., **Saturday, May 15th, 1915**, for the supply and delivery of approximately:

5,460 lineal feet of 48-inch Reinforced Concrete Sewer Tile.

6,200 lineal feet of 36-inch Reinforced Concrete Sewer Tile.

Forms for tender and any other information may be obtained from the office of the City Engineer.

Tenders must be accompanied by a marked cheque as called for in the specification.

Tenders will also be received for alternative materials.

The lowest of any tender not necessarily accepted.

A. B. MANSON,
18-19
City Engineer.

Tenders for Piles and Pile Driving, Incinerator Plant

Tenders will be received, through registered post only, up to **noon on Tuesday, May 25, 1915**, for furnishing and driving piling for Incinerating Plant on Don Roadway.

Tenders must be addressed to the Chairman, Board of Control, City Hall, and be plainly marked on outside of enevlopes, "Tender for furnishing and driving piling for Refuse Incinerating Plant." Specifications and form of tender may be obtained at the Street Commissioner's Office, City Hall. Parties tendering must comply strictly with conditions of City by-law as to deposit and sureties, as set out in specifications and forms of tender.

The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.
Toronto, May 11th, 1915.
19

Tenders Wanted

Sealed tenders addressed to the undersigned and endorsed on the envelope "Tender for Ryerson School, Parry Island, Ont.," will be received up to **noon of the 8th day of June next.**

Plans and specifications may be seen at the Post Offices at Collingwood and Owen Sound, the office of Alexander Logan, Esq., Indian Superintendent, Parry Sound, Ont., and on application to the Department, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, for ten per cent. of the amount of the tender, payable to the order of the undersigned, which amount will be forfeited if the person or persons tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for.

The building to be fully completed and ready for occupation by the first day of September, 1915.

The lowest or any tender not necessarily accepted.

The unauthorized insertion of this advertisement in any newspaper will not be paid for.

DUNCAN C. SCOTT,
Deputy Superintendent General
of Indian Affairs.

Department of Indian Affairs, Ottawa, May 3rd, 1915.—79562.
19

Bridge Tenders

Sealed tenders will be received up to **noon, May 19th**, by Duncan Campbell, Warden of Halton County, Moffat, Ont., for the construction of a 32-foot bridge near Campbellville, and the straightening of the road, involving a fill of 2,060 yards. For plans and information apply to the Warden, P. Weir, Campbellville, or to

BOWMAN & CONNOR, Engineers,
19 31 Queen Street West, Toronto.

Tenders for Filtration Plant

Public Utilities Commissioners of the Town of Brockville, Ont.

Sealed tenders, marked "Tender for Filtration Plant," will be received by C. R. Deacon, Esq., Chairman of the Public Utilities Commission, Brockville, until 5 p.m., **May 17th, 1915**, for the construction of a Mechanical Filtration Plant.

Plans and specifications may be seen, and forms of tender obtained at the office of the undersigned.

The lowest or any tender not necessarily accepted.

G. H. BRYSON,
Town Engineer.
Brockville, April 26th, 1915. 18-19

TOWN OF WALLACEBURG

PROVINCE OF ONTARIO

Tenders for Water Works and Sewers

Sealed tenders will be received by the Town Clerk until **8 p.m. on Tuesday, June 1st, 1915**, for the following works:—

Contract "A-1"—Laying Water Mains.
Contract "A-2"—Laying Sewers.
Contract "O"—Laying Sewer Force Mains.
Contract "P"—Constructing Sewage Pumping Stations.
Contract "T"—Constructing Electric Transmission Line.

Plans and specifications may be seen at the Engineer's Office, Mail Building, Toronto, or at the Resident Engineer's Office, Wallaceburg, on and after May 15th.

The lowest or any tender not necessarily accepted.

T. B. DUNDAS, Esq.,
Mayor.
H. E. JOHNSON, Esq.,
Town Clerk.
CHIPMAN & POWER,
Engineers.
Toronto, May 10th, 1915. 19

ENGINEER

Ten years' experience on construction work, reinforced concrete, sewers, intakes, foundations, dredging (dipper, hydraulic, ladder), cost data, draughting, timekeeping, etc. Best of references. Box 191, Contract Record & Engineering Review, Toronto. 18-19

FOR SALE

A Bargain. Parsons Trenching Machine almost new. Digs to twenty feet deep and up to five feet wide. Box 196, Contract Record, Toronto. 17-19

FOR SALE

Concrete Mixer, 12 ft. cap. "The Standard" Low Charging on truck, with high-grade gasoline engine, complete. New; never been used. In stock at Montreal. Extra low price. Write for particulars. The Standard Scale & Supply Company, 1345-47 Wabash Ave., Chicago, U.S.A. 19-22

fred Bletztein, dry goods merchant, has been totally destroyed by fire.

Pilot Butte, Sask.
A store and pool room occupied by L. M. Morris and O. D. Adams respectively, have been destroyed by fire. The lodge hall of the Orangemen and I. O. O. F. was also damaged. Loss on store, $12,000, insurance, $6,500.

St. Augustin, Que.
The store and residence of E. Germaine have been destroyed by fire. Loss $6,000, insurance $1,000.

St. Boniface, Man.
The club house of the Winnipeg Rowing Club, on the Red River near Linden Avenue, has been damaged by fire to the extent of $3,000. President, C. S. Riley, Assiniboine and Edmonton Streets.

St. John, N.B.
Fire has destroyed the warehouse and offices of C. H. Peters and Sons, Limited, Peters Wharf. The loss, $12,000, is partially covered by insurance. The firm will rebuild at once.

St. Julienne, Que.
The Presbytery and church here have been destroyed by fire, with a loss of $45,000. Insurance $35,000. The parish will rebuild. Curate, Rev. J. A. Jacques.

Strathroy, Ont.
The barn of Charles McGiffin, Main Road, has been destroyed by fire.

Thorold, Ont.
Stores on Clairmont Street belonging to James Doherty, Allanburg, Ont., have been damaged by fire to the extent of about $3,000. Repairs will be made at once.

Todmorden, Ont.
Fire has destroyed a barn, implement shed and silo belonging to James Meagher, 21 Fairview Boulevard, Toronto. Estimated loss, $5,000.

Toronto, Ont.
A warehouse at 26 Duncan Street owned by H. Greisman, 123 University Avenue and occupied by the Canadian Machine Telephone Company, has been damaged by fire to the extent of $4,000.

A disastrous fire has destroyed the summer hospital at Hanlan's Point belonging to the Hospital for Sick Children, College Street. Estimated loss, $100,000.

The factory of John Taylor & Company, 531 Front Street E., has been damaged by fire to the extent of $5,000, covered by insurance.

Fire has totally destroyed the Princess Theatre, 169 King Street West. Leasee, O. B. Sheppard. Loss, $100,000. The Metropolitan Club have sustained a loss of furniture and fixtures.

Tuckersmith Township, Ont.
A barn belonging to D. Fotheringham, London Road, Clinton P. O., has been destroyed by fire.

Tweedside, Ont.
Fire has destroyed the sawmill and planer belonging to Henry S. Shaw. Loss, $3,000. Nn insurance.

Union, Ont.
Samuel Hathaway's barns have been destroyed by fire, with a loss of $4,000.

Vancouver, B.C.
A disastrous fire has destroyed two spans of the Connaught Bridge across False Creek at Cambie Street. Loss, $100,000. The City Council will start repair work at once. Engineer, F. L. Fellowes.

Verdun, Que.
Residences on Argyle Avenue, the property of Jacob Vokey, 319 Argyle Avenue, have been damaged by fire to the extent of about $3,000.

Victoria, B.C.
The premises of Roberts & Bishop, grocers, Burnside and Prideau Roads, have been damaged by fire to the extent of $4,000.

Wallaceburg, Ont.
Fire has damaged a printing office and warehouse occupied by the "Herald-Record," and others. Loss covered by insurance.

Wash, Alta.
Fire has damaged the hotel, occupied by Fred Weis, Thurn's implement warehouse and the offices and sheds of the Citizen's Lumber Company to the extent of $25,000. The hotel carried $1,000 insurance.

Waskada, Man.
The stable and granary of James Forbes have been completely destroyed by fire.

Windsor, Ont.
The lumber mill of John Piggott & Sons, 27 London Street West, has been destroyed by fire, with a loss of about $50,000. The firm will rebuild and will purchase machinery at once for use in temporary quarters.

Miscellaneous

Brant Township, Ont.
The Township Council have authorized the purchase of a road grader and road drags. Clerk, M. A. McCallum, Walkerton, Ont.

Buctouche Beach, N.B.
Tenders will be received until 4 p.m., May 20th, by R. C. Desrochers, Secretary, Department of Public Works, Ottawa, for dredging at Lower Derby, Northumberland County, and at Buctouche Beach, Kent County. Chart and specifications at office of MacLean Daily Reports, 25 Charlotte Street, Toronto, and at the Department, Ottawa.

Calgary, Alta.
The City Council will shortly call for tenders on the establishment of an amusement ground in Bowness Park. Clerk, J. M. Miller.

Charlottetown, P.E.I.
The Secretary, Department of Public Works, Ottawa, will receive tenders until 4 p.m., May 27th, for dredging Rocky Point, Charlottetown Harbor. Plans and specifications at the Department, Ottawa.

Dundas, Ont.
The Town Council are in the market for a hose wagon, etc. Clerk, J. S. Fry.

Hull, Que.
A by-law has been passed to provide for the construction of a booster plant at Tetreauville District.

London, Ont.
Webster & Smallman, care of John Smallman, Elmwood Avenue, may be in the market shortly for the supply of cement for the manufacture of concrete pipe.

Montreal, Que.
The City Council have instructed the Park Superintendent to prepare plans for two comfort stations to be erected in Lafontaine Park. Secretary, L. N. Senecal.

Ottawa, Ont.
S. J. Willoughby, 64 Powell Avenue, is about to start work on alterations to three buildings on Bayswater Street. Brick veneer construction. Estimated cost, $3,000.

The Dominion Government are considering a propisition for raising the level of the St. Lawrence River by a system of retaining dykes, and the damming of subsidiary channels. A report on this work has been prepared by E. E. Haskell, Dean of the College of Civil Engineering, Cornell University; V. W. Forneret, Superintending Engineer of the St. Lawrence Ship Channel, and W. J. Stewart, Hydrographer. Dams will be of rock filled construction. Approximate cost of work, $487,000.

Summerside, P.E.I.
The T. Johnson Company, Limited, are in the market for hollow tile, marble, slate and a vacuum cleaner.

Toronto, Ont.
Tenders on dredging at the Eastern Gap, Toronto, will be received until 4 p.m., May 20th, by R. C. Desrochers, Department of Public Works, Ottawa, Plans and specifications at office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

Wyoming, Ont.
George Hodgins contemplates the purchase of machinery for the manufacture of cement blocks.

Winnipeg, Man.
The Chairman of the Board of Control will receive tenders until May 14th for the supply of between five and ten thousand barrels of cement and five hundred to a thousand tons of refined asphalt. Engineer, W. P. Brereton.

Yarmouth, N.S.
The Town Council contemplate making extensions to the fire alarm system, the installation of a large bell and the purchase of 1,000 feet of rubber hose, coats, etc. Clerk, Hiram Goudey.

CONTRACTS AWARDED

Hamilton, Ont.
The contract for the construction of a conservatory for Gordon K. Fraser, 201 Lister Building, has been let to Lord & Burnham, 1301 Royal Bank Building, Toronto.

The contract for concrete sewer pipe for the sanitary sewer at East Hamilton has been awarded by the city to B. Blair & Company, of Woodstock. The work will be commenced at once.

Westmount, Que.
The general contract for the erection of comfort stations and shelters in Westmount Park has been let by the City Council to Reid, MacGregor & Reid, Drummond Building, Montreal. Estimated cost, $5,600.

Late News Items

Belmont, Ont.
The general contract for the erection of a school here has been let to Horton Bros., St. Thomas, Ont., at $7,000. Smaller trades will be sublet.

Craik, Sask.
Tenders will be received until May 18th by Walter Campbell, Craik, for the construction of extensions to the rural telephone system here for the Argyle Rural Telephone Company. Work to be done according to Saskatchewan Government plans and specifications.

Eel Brook, N.S.
The Municipality will receive tenders until noon, May 22nd, for the construction of a bridge and embankment approaches. Plans and specifications at offices of E. H. Armstrong, Commissioner of Public Works, Halifax, N.S., and Albert Gayton, Registrar of Deeds, Yarmouth.

Fredericton, N.B.
Tenders will be received until May 28th by F. Neil Brodie, Architect, 42 Princess Street, St. John, N.B., for the erection of an annex to Victoria Hospital. Approximate cost, $20,000.

Montreal, Que.
C. A. Paradis, 23 Mentana Street, is about to commence the erection of alterations and extensions to five flats on Mentana Street, at an estimated cost of $5,000.

Plans have been drawn for ten flats to be erected by Joseph Demers, 627 Marquette Street. Estimated cost, $12,000.

Ottawa, Ont.
Work is about to start by day labor on the erection of a residence for W. Herbert George, Castle Building, Queen Street. Approximate cost, $10,000.

Ernest Sanders & Company, 377 Somerset Street, have commenced the erection of a residence at Rockliffe Park for J. Connors, care of Seybold & Gibson, 80 Elgin Street. Stucco and brick construction. Estimated cost, $7,000.

The general contract for the erection of a residence on Frank Street for F. Argue has been let to Alexander & Campbell, 245 Bank Street, and the heating and plumbing contract to M. M. O'Connor, 212 Gloucester Street. Other trades not let. These firms have also been awarded contracts in connection with alterations and additions to apartments on James Street for F. Argue, 196 James Street.

Quebec, Que.
In connection with repairs to the Y. M. C. A. gymnasium on St. John Street, the carpentry contract has been let to L. H. Peters, Limited, 10 St. Angele Street, and the contract for the electrical work to Quebec Electric Company, St. John Street. Approximate cost, $8,000.

Royal Oak, B.C.
The following contracts have been let in connection with the construction of a waterworks system for the Municipality of Saanich:—cast iron pipe and special castings, Balfour, Guthrie & Company, 739 Hastings Street W., Vancouver; 100 hydrants, Yarrows Limited, Esquimalt, B.C.; 100 hydrants, Victoria Machinery Depot, 343 Bay Street, Victoria; 25 hydrants, Renssalaer Valve Company; single and double air valves and 12-inch pressure reducing valve, A. J. Forsyth & Company, 325 Howe Street, Vancouver; 4-inch, 5-inch, 6-inch and 8-inch double socket gate valves, W. O'Neil & Company, 550 Seymour Street, Vancouver; 6-inch and 10-inch reflux valves, 12-inch double socket gate valves, Renssalaer Valve Company.

St. Donat, Que.
The Parish have had plans drawn for a presbytery to be erected by day labor, at an estimated cost of $7,000. Concrete foundation, frame and mill construction, metal roofing.

St. Louis De Courville, Que.
The interior fittings contract in connection with the erection of a church here has been let to F. P. Gauvin, St. John Street, Quebec. Painting and electrical work not let.

Toronto, Ont.
Frank Barber, Township Engineer, 57 Adelaide Street East, will receive tenders until May 17th for the construction of a sewer on Humewood Avenue. Plans, etc., at Engineer's office.

The ratepayers of Cartierville, P.Q., have voted in favor of the purchase of the waterworks system from the Montreal Public Service Corporation. The Council have also decided to construct a filtration plant.

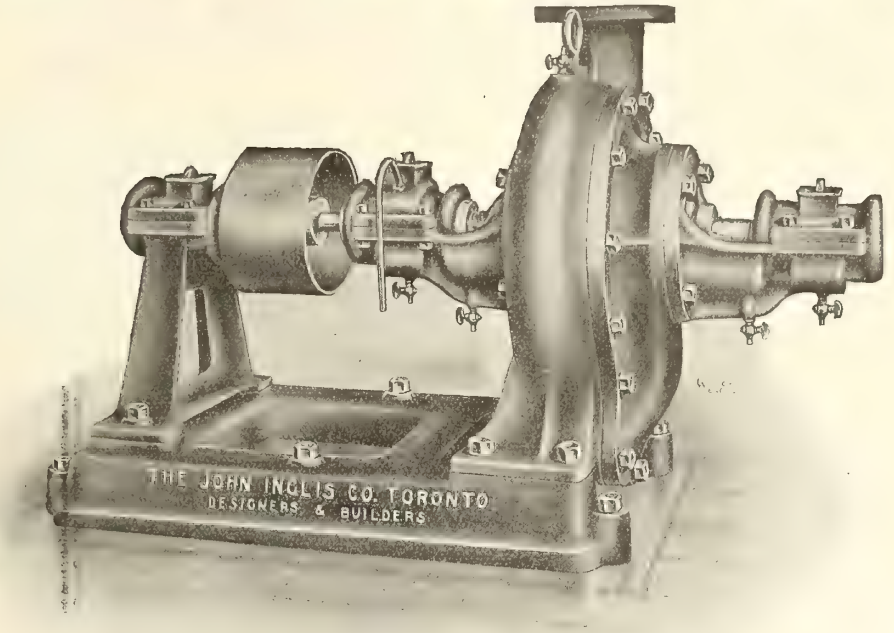
The Montreal offices of the Canada Wire and Cable Company, Limited, and Maloney Electric Company of Canada, Limited, have been removed from 401 Lake of the Woods Building, to 501 Merchants Bank Building.

Notable among recent constructional measures in the province of Quebec are two by-laws passed at Hull—one for extending the water-works at a cost of $200,000, and the other for extending the redistribution station at a cost of $100,000.

Messrs. Chas. D. Kirk Company, sanitary, heating and ventilating engineers, 312 Tribune Building, Winnipeg, are desirous of obtaining catalogues of plumbing, heating and ventilating material, water supply systems, pumps, sewage ejector systems, air compressors, tanks and boilers.

Messrs. H. W. Aird, Canada Paint Company, Limited.; B. W. Coghlin, B. J. Coghlin Co., Ltd.; G. H. Duggan, Dominion Bridge Co., Ltd.; Percy S. McKergow, National Brick Co., of Laprairie, Ltd.; R. H. McMaster, Steel Co. of Canada Ltd., have been elected members of the executive committee of the Montreal branch of the Canadian Manufacturers' Association. At the annual meeting a plan was outlined for increasing Canadian export trade. The idea is to form an export company, to operate to a certain extent on a co-operative basis. The name of the company will be The Canadian Manufacturers' Export Association, Limited. Mr. F. C. Armstrong, who has charge of the organization work, stated that in the first place such an organization would aid Canadian manufacturers to pursue their own lines of enterprise, while in the second it would operate as a commission agent between the Canadian manufacturers and the foreign markets. The Government and the railway companies were strongly in favor of such a propaganda, and ready to help it, while the banks were also sympathetic.

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

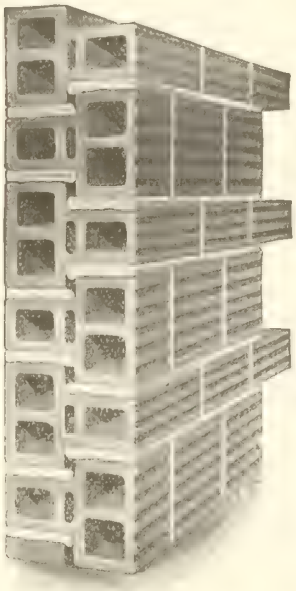
INGLIS' PRODUCTS ARE "MADE IN CANADA"

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Montreal Office: Room 509 Canadian Express Building
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Denison Interlocking Hollow Tile Assures "Safety First" in Building



Eight Inch Wall
Builds like a Thermos Bottle

Safety in construction because of its bonding and interlocking features which are unequalled by any other tile.

Safety in a healthful way because no moisture can seep in. There are no mortar joints extending through the wall.

Safety in the matter of heating for the dead air spaces insulate it against heat and cold.

Safety in fireproof features.

Canadian builders should specify Denison Interlocking Hollow Tile because it's well made in Toronto, Canada.

Twelve Inch Wall
Builds like a Thermos Bottle.

SUN BRICK CO., Limited

The One Price Company

Traders Bank Building TORONTO, ONT.

Save 50% on Stone Sawing

Anderson "Diamond Reinforced" Saw Tooth

After costly experimenting, we have produced a Saw Tooth which enables diamond saw owners to reduce their cutting (independent of labour) by 50 per cent.

This Tooth is the "ANDERSON REINFORCED DIAMOND SAW TOOTH."

This Tooth contains, instead of one solid diamond, a number of small pieces making up the same weight. The double advantage being that it COSTS LESS and LASTS LONGER.

With the Reinforced Diamond Tooth the diamond is inserted in a broken condition, and perfectly reinforced with steel. As the tooth wears down only small pieces can go to waste, mere dust, and it is impossible for them to suffer loss through entire or partial breakage so common with teeth cutting the harder building stones.

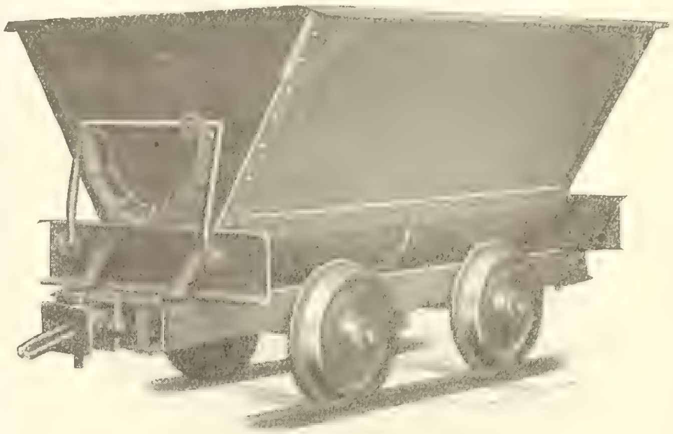
When the first layer of the small pieces have done their work and are worn away, the second layer comes into cutting action, and so on, until the teeth are worn out.

Write us for prices.

Geo. Anderson & Co.
of Canada Limited
QUEBEC BANK BUILDING,
MONTREAL

Steel Dump Cars

Any Size or Design
Workmanship Guaranteed
Prompt Delivery Prices Moderate



(Car Dumps Either Side)

Let us Quote on Your Requirements.

Marsh & Henthorn, Limited
Belleville, Ontario

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Air Compressors

of Belliss Make have gained their reputation for

- Simplicity of Design
- Compact Design
- Continuous Operation
- Noiseless Running
- Low Oil Consumption
- Overall Efficiency

Messrs. Belliss & Morcom, Ltd.
BIRMINGHAM, ENGLAND

Agents
Laurie & Lamb
Board of Trade Building, MONTREAL

Canada Wire & Cable Co., Limited
Head Office and Works, TORONTO

Bare and Insulated Electrical Wires for all purposes.

Electric Railway Trolley Wire and Feeder Cable.

Sales Offices and Branch Warehouses:
401 Lake of the Woods Building, MONTREAL.
150 Princess Street, WINNIPEG.
Macdonald Marpole Co., Ltd., 427 Seymour St., VANCOUVER.
Canada West Electric, Ltd., REGINA and EDMONTON.
Northwestern Engineering & Construction Company, Limited, CALGARY.

Prompt shipments from Factory or nearest warehouse.

RIVETED TANKS
RIVETED PIPES
PONTOONS

and other similar works

Manufactured by
Canadian Stewart Co., Limited
TORONTO

BITUNAMEL

Unsurpassed for waterproofing foundations and preventing rust and corrosion on exposed iron and metal work.

WRITE FOR SAMPLE

The Ault & Wiborg Co. of Canada Ltd., Varnish Works
Montreal TORONTO Winnipeg

This **STONE CRUSHER** IS THE
Pat **"ACME"** Reg.
The Machine of
QUALITY and MERIT.

Goodwin, Barsby & Co., Leicester, Eng.

Do You Want Crushed Stone ?

That is Clean, Tough Stone of a Quality suitable for Macadam Road and Concrete

We can supply you in any size or quantity.
Our service is unexcelled and our prices right.

Phone or write us for quotations when you are in the market.

Office—M 4515—M 4516 Residence—P 2278

Crushed Stone Limited
47 Yonge St. Arcade, Toronto
G. W. Essery, Manager

BROWNING
LOCOMOTIVE CRANES

SEND us a brief description of the nature of your job. We will send you practical photographs and data of similar work showing how it was accomplished. Regardless of what pile-driver, shovel or crane you will use, data like this is valuable. We gladly furnish it. Write.

THE BROWNING COMPANY
CLEVELAND, OHIO
Sales Offices: New York, Chicago, Philadelphia, San Francisco,

KAHN CURB BARS

The scientific, practical, efficient and economical protection for edges of concrete curbs, columns, walls, entrance posts, platforms.

Write for Highway pamphlet describing Curb Bar and also Armour Plates.

Straight or Curved Bars

Unit of Plate and Anchorage, Substantial Steel Protection. Rigid, Positive Anchorage. No Splitting of Concrete. Easy to handle and install.

KAHN SYSTEM Building Products

TRUSSED CONCRETE STEEL CO. OF CANADA, LIMITED, Walkerville, Ont.

Sales Offices
Welland - Ontario
Cobalt - Ontario
7 Bank Street Chambers
Ottawa
417 New Birks Building
Montreal

Beams—Channels
Angles—Plates
Always in Stock

Reinforcing Bars
'Self-Sentering"

Corrugated Sheeting
Send for Stock List

STANDARD STEEL CONSTRUCTION CO.
LIMITED
WELLAND - CANADA
MANUFACTURERS AND ERECTORS

Steel Buildings and Bridges

STRUCTURAL STEEL FOR QUICK DELIVERY

We carry in stock at Montreal 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

Bridges, Roof Trusses, Columns, Girders, Beams, Towers and Tanks, Penstock.

Estimates furnished promptly, Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
Main Office and Works, Montreal

"AMERICAN"
ENAMELED BRICK

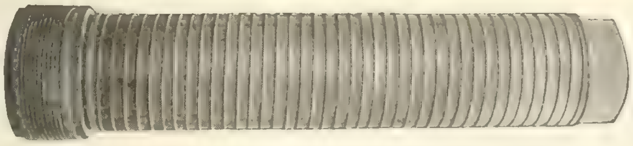
used for prominent and representative buildings of every character.

Their INDIVIDUALITY, DISTINCTIVENESS and BEAUTY make them especially adaptable for exterior use.

Write for information.

AMERICAN ENAMELED BRICK & TILE COMPANY
1182 Broadway, New York.

VANCOUVER WOOD PIPE & TANK CO., LTD.



Contractors for Waterworks Construction, Manufacturers of Wire-Wound Wood Pipe, Continuous Stave Pipe, Tanks, Silos, Steam Casing.

See our new patented Wood Pipe Coupling—Positively LEAK PROOF.

Wr te for 1915 Catalogue

319 Pender St. **VANCOUVER, B.C.**

TONCAN METAL
CULVERTS
Last for Years and Years

Moisture alone is a corrosive element.

But when the water flowing through a culvert contains other natural corrosive elements, such as alkali and acid for instance, the need for a corrosion-resisting culvert is further emphasized.

TONCAN METAL

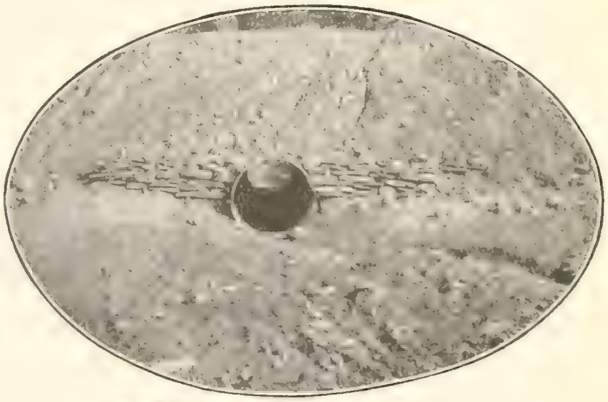
Combats Rust and Corrosion

A culvert made of Toncan Metal Sheets is economical, because it is
1st —Rust and Corrosion-resisting
2nd—Low in Cost
3rd—Easy to Ship and Haul
4th—Easy to Install
5th—Strong

Conclusive and satisfying evidence of Toncan Metal's durability is contained in the "Text Book on Corrosion." Write for it.

The Pedlar People, Limited
Oshawa, Ont. Culvert Makers

The Stark Rolling Mill Company
Canton, Ohio Mfrs. of TONCAN METAL



No fill too deep for a Toncan Metal Culvert.

To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

from

Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited

KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.

High Calcium Lime

Manufactured by

The Dominion Lime Company,

SHERBROOKE, - - PROVINCE OF QUEBEC

Its Special advantages are:

Strength,
Whiteness,
Purity

Builders admit that our Lime takes more sand and is therefore cheaper to use.

Shipped in Bulk or Barrels.

Will give 25% better results to CONTRACTORS, PAPER MANUFACTURERS and OTHERS, than the ordinary lime.

Electric Steel Castings

We can supply

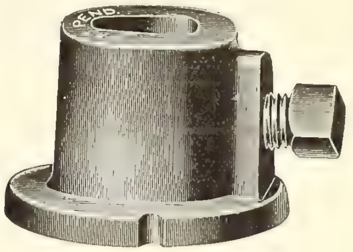
Carbon, Manganese, Alloy, Steel Castings,
Forging Ingots, Etc.

Write for prices and particulars.

The Electric Steel & Metals Co., Limited
Welland - Ontario

Use UNIVERSAL CLAMPS

to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section, showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screws tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

One Clamp for walls, columns and soffits This clamp is literally *universal* in application. With these low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

Write for circulars and prices. We'll send a sample clamp for 10c. to pay postage and packing.

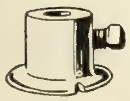


Fig. 1

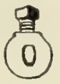


Fig. 2

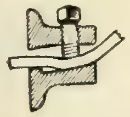


Fig. 3

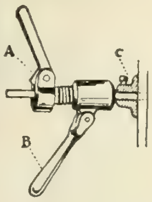


Fig. 4

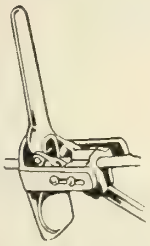


Fig. 5

Universal Form Clamp Co.

Sole Representatives for Ontario and Eastern Canada:
Railway Contractors Supply Company
504 Standard Bank Bldg., Toronto
Montreal representatives—Ramsey & Kelly, 511 Quebec Bank Bldg

Universal Form Clamp Co., 504 Standard Bank Bldg.,
Toronto
I enclose 10c. Please send me a sample Universal Clamp.
Name....................................
Address....................................

Keiths LIMITED

SAFETY FIRST

being interpreted means

Associated Automatic Sprinklers

and spells

Conservation of LIFE, PROPERTY and CASH

Automatic Sprinkler Protection provides Practical Immunity from Fire Loss and a Saving on Insurance Premiums of 40 to 60%.

Our address is
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Quebec Office: 707 New Birks Bldg., Montreal

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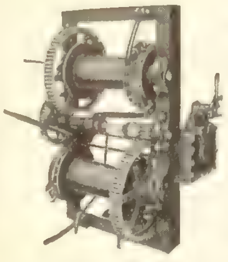
STEAM and AIR ENGINES, HOISTING ENGINES, STEAM CRANE HOISTS, MOTOR CRABS, SWINGING ENGINES, DRILL HOISTS, SPUD HOISTS, MARINE MACHINERY



Motor Crab

Write for catalog and prices

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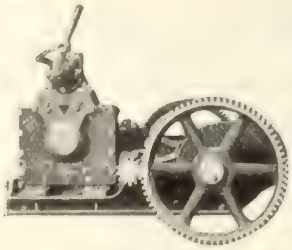

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Sand, Gravel and Crushed Stone

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Keep the money at home where it will circulate back to you. Especially when you can get equal or better values at home. The "Metallic" line of building materials is British-made through and through

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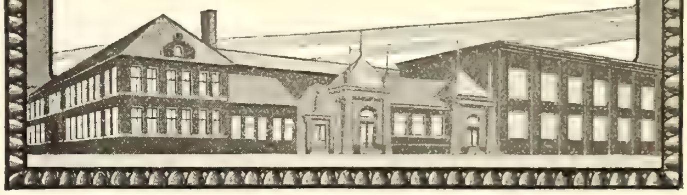

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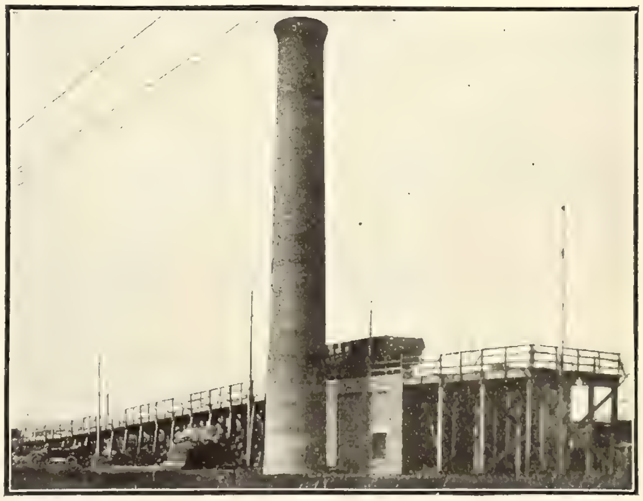

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The Ideal Incinerator and Contracting Co., Limited
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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $21; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22; No. 2 Hemlock, dimension and 1 in., $19 to $21.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $42; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $27; No. 1 pine decking D 2 S, $28; spruce decking, $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casin, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $3.40 to $4.50; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.40; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $4.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto proces (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.5d to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 81c. per gal of 9 lbs.

Raw linseed oil—in bbls., 78c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bbls., 73c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.50; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30. in. dimensions and over, $2.45; under 30 in. dimensions, $3.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.60; 28 gauge, $3.25 per sq. yd. net cash. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.85 per 100 lbs.; Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14½c basis per pound; British manilla, 12½c basis; African hemp, 12½c; sisal rope, 10½c basis; lath yarn, 9¾c. Boiled linseed oil—in barrels, 82½c per gal. of 9 lbs. Raw lin seed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, ship-lap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles. beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

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Plain Round, Square and Cold Twisted Squares

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page (66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 30 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $35 at warehouse, $33 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35; fire clay, $12 per ton.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $5.35 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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Material Handling Equipment

On work where exacting and uninterrupted service is of vital importance, the Contractor who knows, uses BEATTY Hoists because of their proven RELIABILITY.

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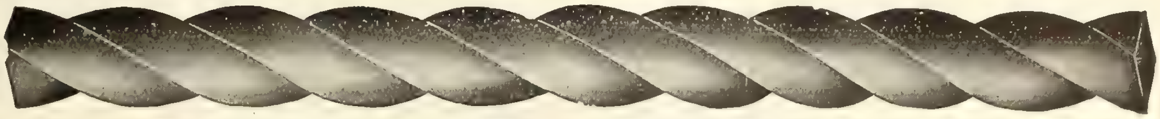

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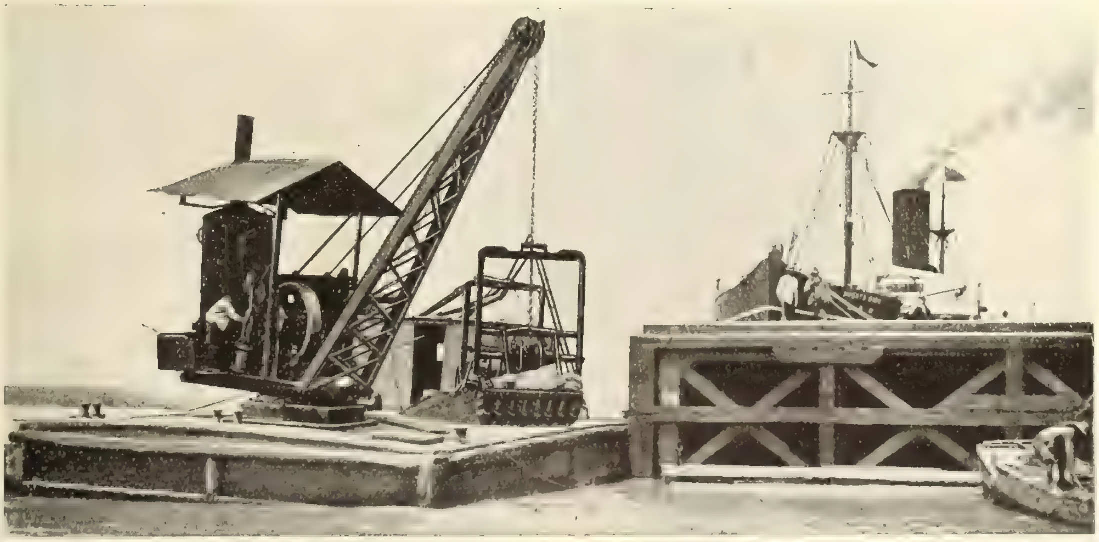

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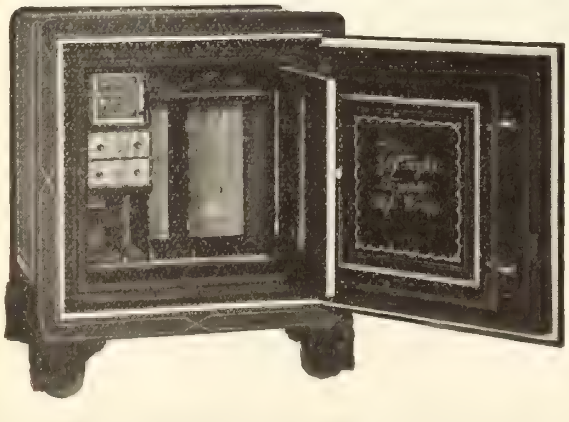

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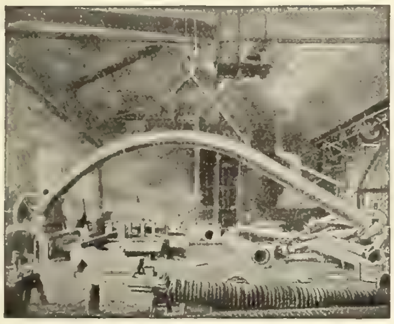

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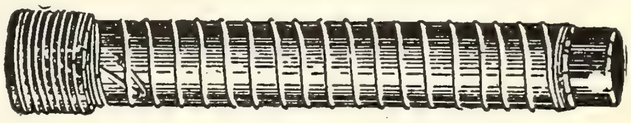

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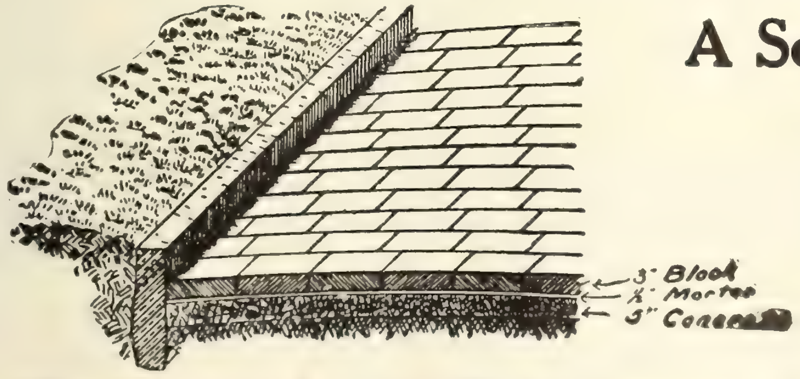

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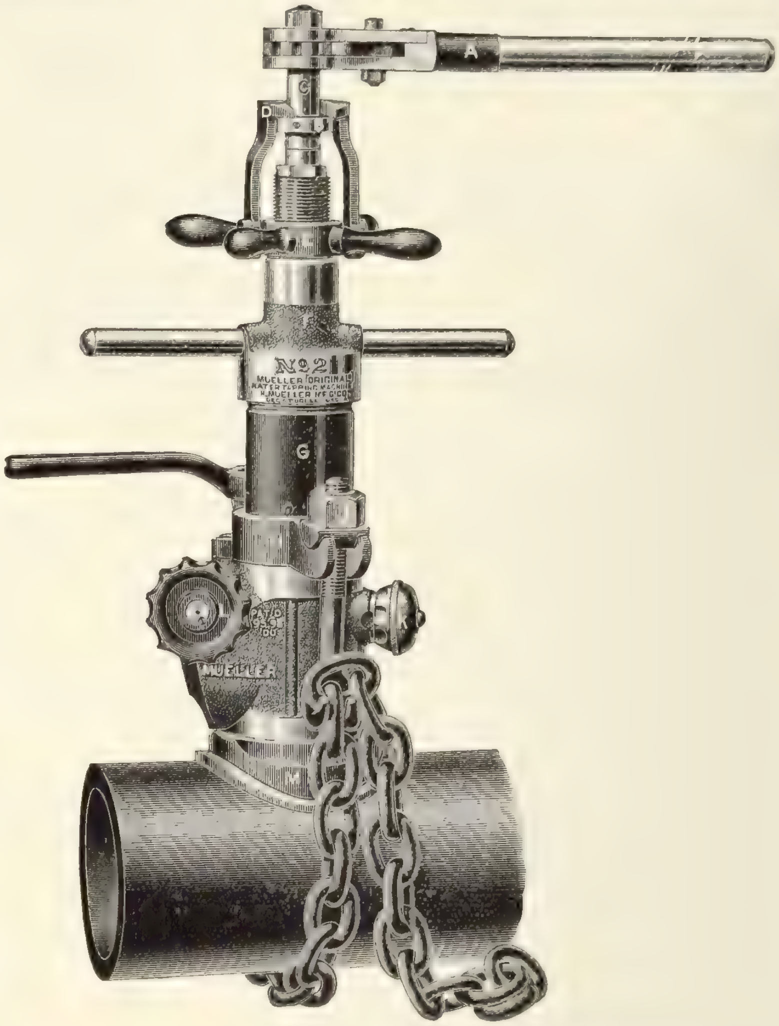

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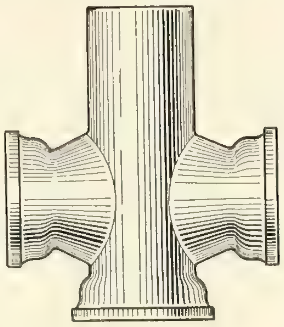

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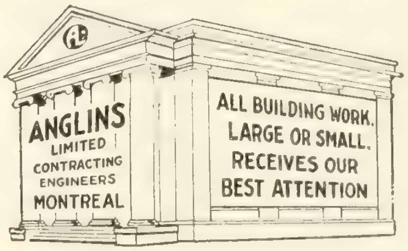

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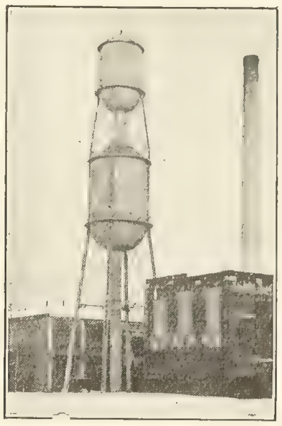

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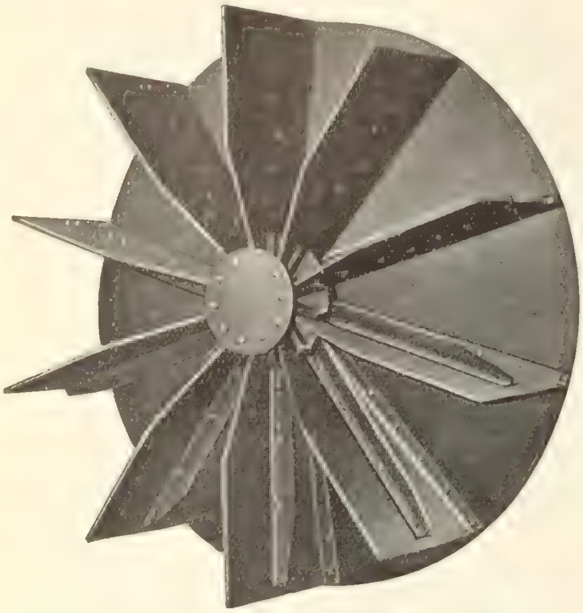

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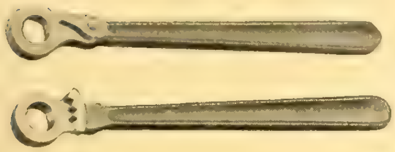

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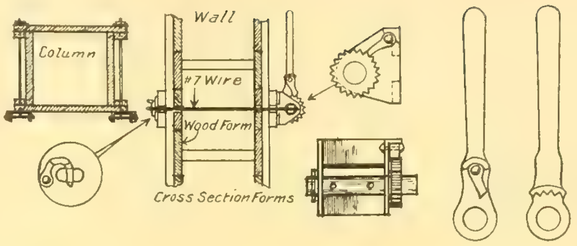

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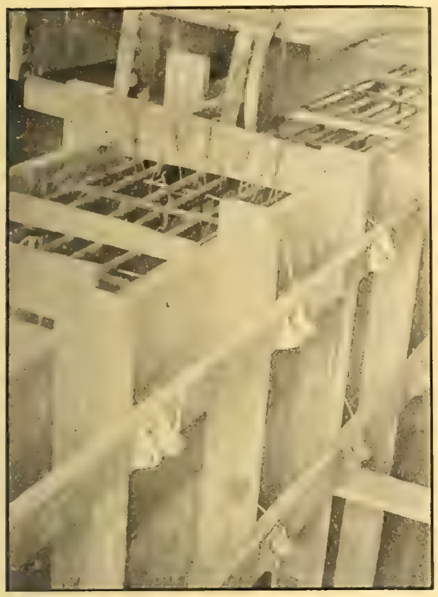

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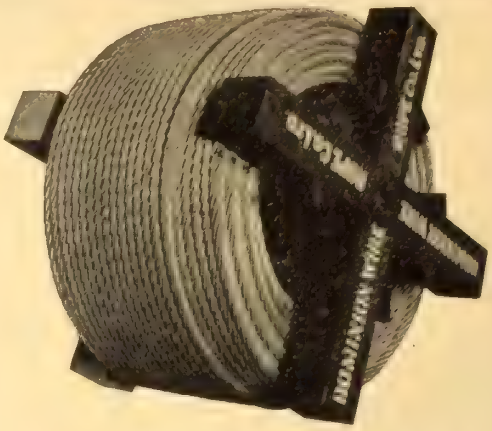

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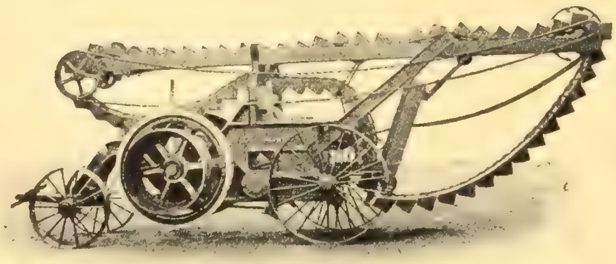

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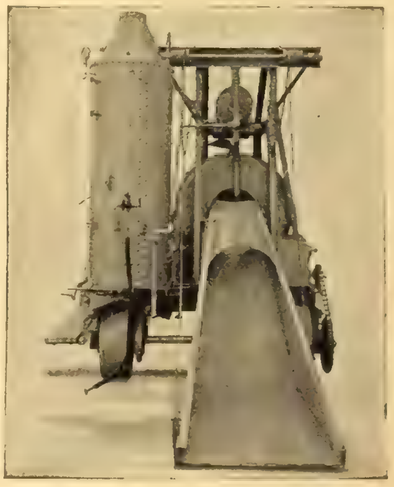

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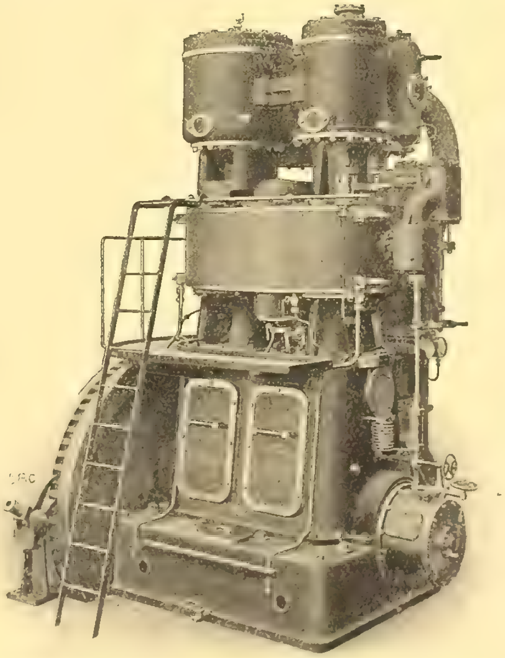

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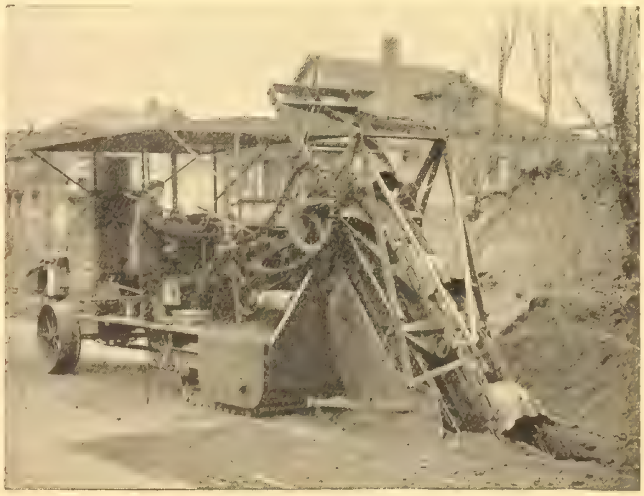

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Lecky & Collis, Limited, 49 Beaver Hall Hill, MONTREAL; 43 Scott St., TORONTO, or P.O. Box 611, NAPANEE, ONT.
Canadian Equipment & Supply Co., CALGARY and EDMONTON. Dominion Equipment & Supply Co., WINNIPEG, MAN.

F. C. AUSTIN DRAINAGE EXCAVATOR CO. Railway Exchange, CHICAGO, U.S.A.
Agents Wanted in Open Territory

28 "Service" Branches
Throughout Canada

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Rubber Company, Limited
Montreal, P. Q.

"GET THE HABIT"

Buy Rubber Goods

(Tires, Hose, Belting, Packing, Etc.)

Made In Canada

GET ANOTHER HABIT

Buy Them From Us

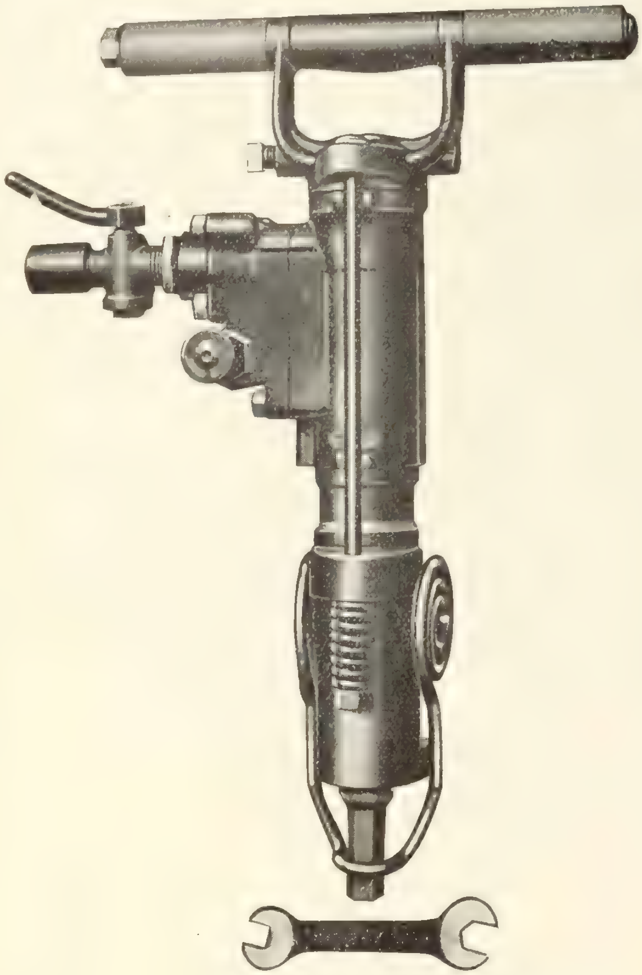
Our line-up is complete, our quality is unexcelled, and our prices are right. Let us show you what we can do.

It is our desire to serve you.

Canadian Consolidated
Rubber Company, Limited
Montreal, P. Q.

28 "Service" Branches
Throughout Canada

JACKHAMER



Operates by steam
or air.

Drills up to 16 ft. holes.

Used for
Open Cut Work
Trench Excavation
Breaking Boulders
Shaft Sinking
Drifting
Boring Coal
Trimming Walls

This tool rotates automatically and full air pressure may be directed through the hollow steel to completely clear the hole of all cuttings. This permits of drilling deep holes.

Illustration covers all the latest improvements.

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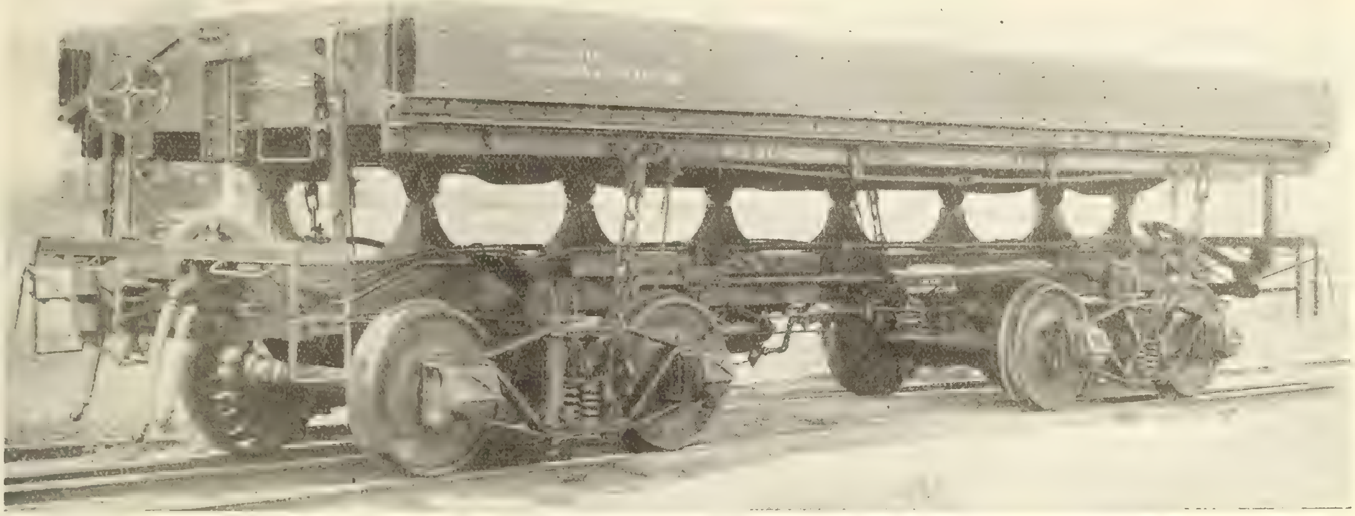
COMMERCIAL UNION BUILDING, MONTREAL, CAN. - WORKS: SHERBROOKE, QUE.

Sydney, Montreal, Toronto, Cobalt, Timmins, Winnipeg, Nelson, Vancouver.

"Imitation is the sincerest form of flattery"



This photo shows the

WESTERN AIR DUMP CAR

which is being copied by other car builders. See these cars in operation on the Welland ship canal; Montreal aqueduct; Ocean terminals, Halifax; St. Charles River improvements, Quebec; Canadian Pacific Railway; Grand Trunk Pacific Railway; Quebec harbour, and on practically all jobs where dump cars are used, and compare them with the cars offered you as being "just as good."

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(Steam and Electric Shovels, Dredges, Pile Drivers, Wrecking Cranes, etc.)

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(Continued on page 12)

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for

Water and Gas Supply, Fire Protection, Road Culverts, etc.

30″ Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

General Offices:—BURLINGTON, NEW JERSEY

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DUNDAS QUARRY

Capacity 4000 Tons Daily

OUR

Facilities for supplying any quantity of

CLEAN CRUSHED STONE

Are Unexcelled

SHIPMENTS — G. T. R. & C. P. R.

Team Delivery If Required

CEMENT

SAND

GRANOLITHIC

TRAP-ROCK

Rogers Supply Co., Limited

28 King St. W., Toronto

MAIN 4155

Fig. C 21. Mantel Clock

ARTISTIC MERIT

as well as accuracy in Time-keeping is embodied in all Pulsynetic Electric Clocks. No matter whether they are to be fixed in the Residence, Office, Factory, Warehouse, or Tower, we have the correct design at the right price.

One master transmitter controls any number of dials, irrespective of size or position and never wants winding.

Architects, Engineers and all interested in Correct Time should send at once for our Book Five, or full particulars and prices may be obtained from:—

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TORONTO

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Cables, Lodestone

KERR

Gate Valves

and

Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

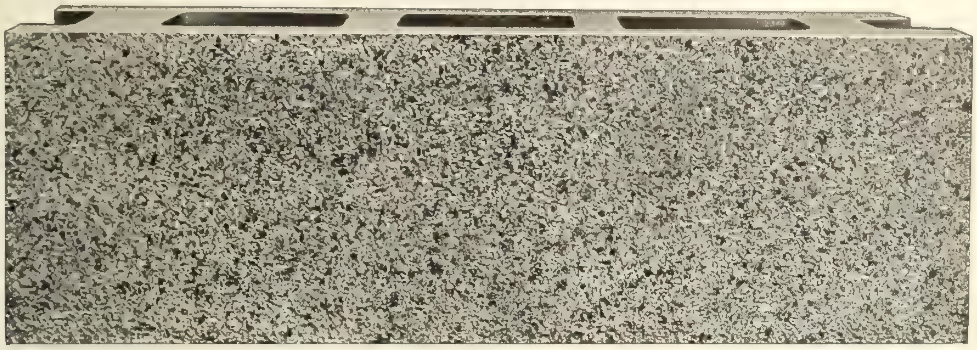
The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO

8 x 8 x 24 inch Granite Rock Face Block

Molds for Casting
Waterproof Hollow
Cement Building Blocks
With Granite Faces

THEY COST LESS — THEY SELL FOR MORE
YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

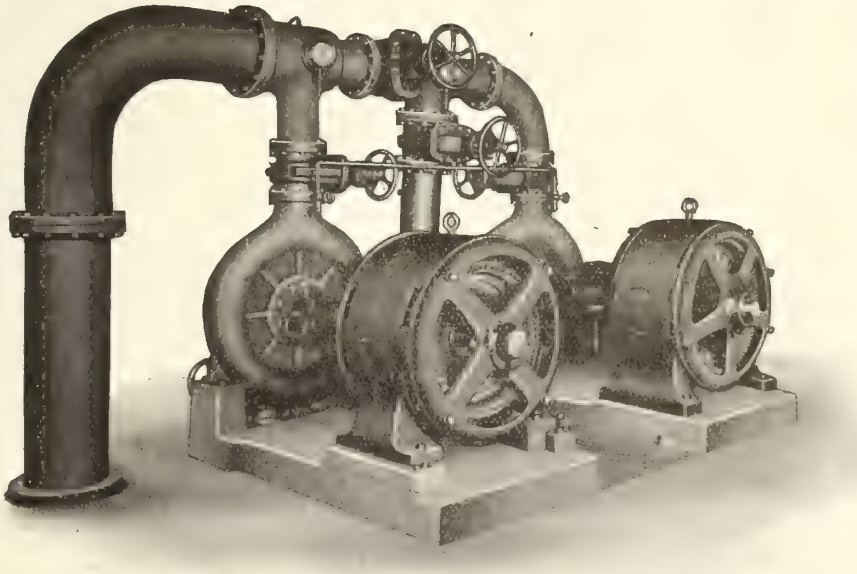
Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited (Zagelmeyer System)
298 Howard Avenue, WINDSOR, ONTARIO

Turbine
Pumps
Electric and Steam
Water Works
Factory and
Fire Services
Humphrey Gas
Pumps
Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL
CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

The color that never grows tiresome—RED.

The brick that never never fades—

"PRESSED BRADFORD BRICK"
(TRADE MARK REG. U. S. PATENT OFFICE)

"BRADFORD REDS" our smooth brick, noted for its uniform texture and rich unfading red color. Made in both dry pressed and impervious.

"Bradford Ruffs," a fine rough-textured red brick for building bungalows, garden walls and wherever unusual or rustic effects are desired.

Write for the RED Catalog.

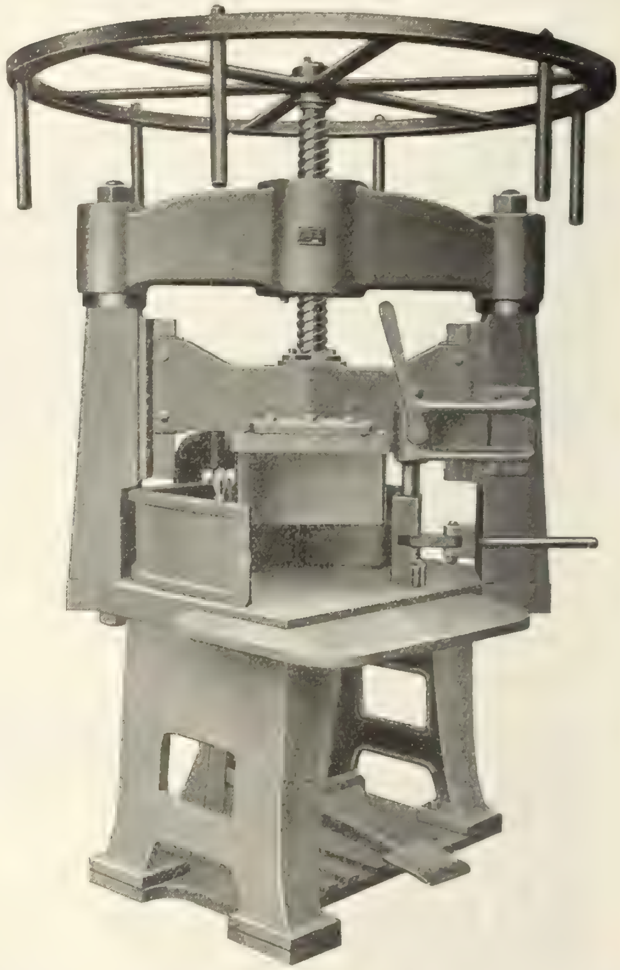
Bradford Pressed Brick Co.
"The Red Brick People"
Bradford, Pa.

We also make fire-proofing Hollow Brick and Hollow Block.

We manufacture the most comprehensive range of

CLAY-WORKING MACHINERY

in the world



The Crossley Improved Sagger Press

The Crossley Improved Sagger Press, capable of making from 600 to 800 saggers per ten hours, according to height, at a manufacturing cost of less than one cent each. In the operation of this press, one man is required to superintend the hand wheel, one to operate the die and a boy to cut off the clay as it comes from the pug mill, and remove the finished saggers to the drying room.

This is but one of our modern machines for progressive clay-workers. Write for 180-page catalogue.

The Crossley Machine Co.
Trenton, New Jersey, U. S. A.

TRADE MARK

Hull Iron & Steel Foundries, Limited

Head Office and Works - HULL, QUEBEC

Manufacturers of Steel Castings

Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Repair parts for Stone Crushing Plants, Mining Machinery and Cement Mills our specialty.

Machine Moulded Gears

any size up to 18 feet in diameter made without patterns.

We solicit your patronage and prompt attention will be given to any orders.

London Bull Dog Batch Mixer

London Bull Dog Batch Mixer

A small size Mixer BUILT to do Big Work on small jobs.
50 cu. yds. per day, 6 cu. ft. per batch. BUILT to Last a Life Time.
Light and easily moved. Can be operated with few men. This machine will save the price of itself on a small job in Twenty Days' Use.

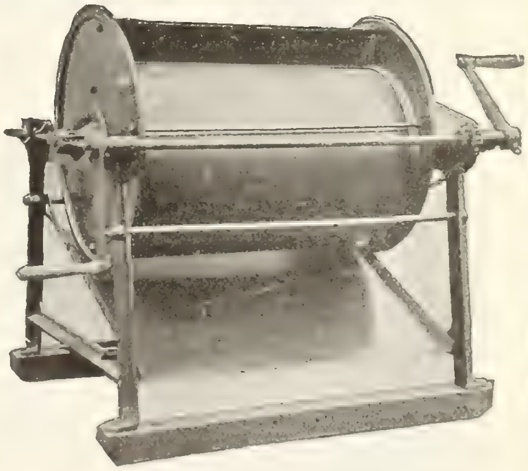
Send for Catalogue No. 1B.

Little Giant Hand Mixer

The only satisfactory Hand Mixer on the market. Meets every requirement.

Easy to Operate. Easy to Clean. Does Perfect Work. Capacity 3½ cu. ft. per batch. Just the Machine for small jobs. Write for particulars. Send for Catalogue No. 1G.

We make Twenty-Three Different Sizes of Cement Mixers and a full line of Concrete Machinery and Cement Working Tools.



Little Giant Hand Mixer.

London Concrete Machinery Co., Limited, London, Ont.

Branches and Agencies in every large city in Canada.
WORLD'S LARGEST MANUFACTURERS OF CONCRETE MACHINERY AND CEMENT WORKING TOOLS.

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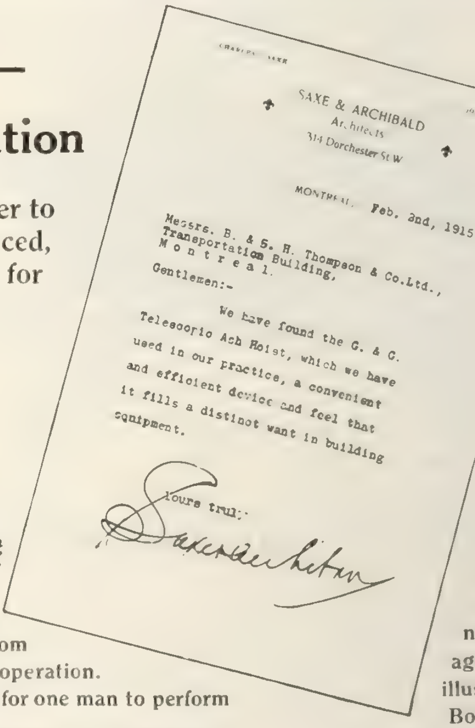
(Continued on Page 14)

SAUVEGARDE BUILDING.
MONTREAL.

In Montreal alone, a number of the most prominent buildings are equipped with the G & G Telescopic Hoist.

Another Letter—
And Another Installation

Messrs. Saxe & Archibald whose letter to our Montreal agents is here reproduced, specified the G & G Telescopic Hoist for the La Sauvegarde Building.



CHARLES SAXE
SAXE & ARCHIBALD
Architects
314 Dorchester St W
JOHN S. ARCHIBALD

MONTREAL, Feb. 2nd, 1915.

Messrs. B. & S. H. Thompson & Co. Ltd.,
Transportation Building,
M o n t r e a l.

Gentlemen:-

We have found the G. & G. Telescopic Ash Hoist, which we have used in our practice, a convenient and efficient device and feel that it fills a distinct want in building equipment.

Yours truly:

Saxe & Archibald

The G&G PATENTED Telescopic Hoist
with compound gear and brake attachment

Raises a maximum load of 500 lbs. at a speed of 30 feet per minute, operated from sidewalk. Clean, safe and **noiseless** in operation.
Only ash hoist with which it is practical for one man to perform entire removal of ashes.

"Made in Canada"

Write to nearest agent for illustrated Booklet and Prices

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**"MADE
IN
CANADA"**

TRADE **CHAMPION** MARK

ROCK CRUSHERS

The frame of a rock crusher is subject to a tensile or pulling strain, and as forged or rolled material is the only material that is absolutely safe under such a strain, the main frame of all CHAMPION ROCK CRUSHERS is made from high carbon special rolled steel plate, which makes it entirely safe from the secret flaws common to any "cast" material.

Careful construction means long life and it is with this end in view, that the smallest detail in mechanical construction is thoroughly gone into and carried out, so that the completed machine is not only simple in construction but safe and durable in operation.

CHAMPION ROCK CRUSHERS are used in both stationary plants or mounted upon trucks where a portable plant is desired.

A full and complete line of STONE, SAND, and GRAVEL ELEVATORS, SCREENS and all ACCESSORIES.

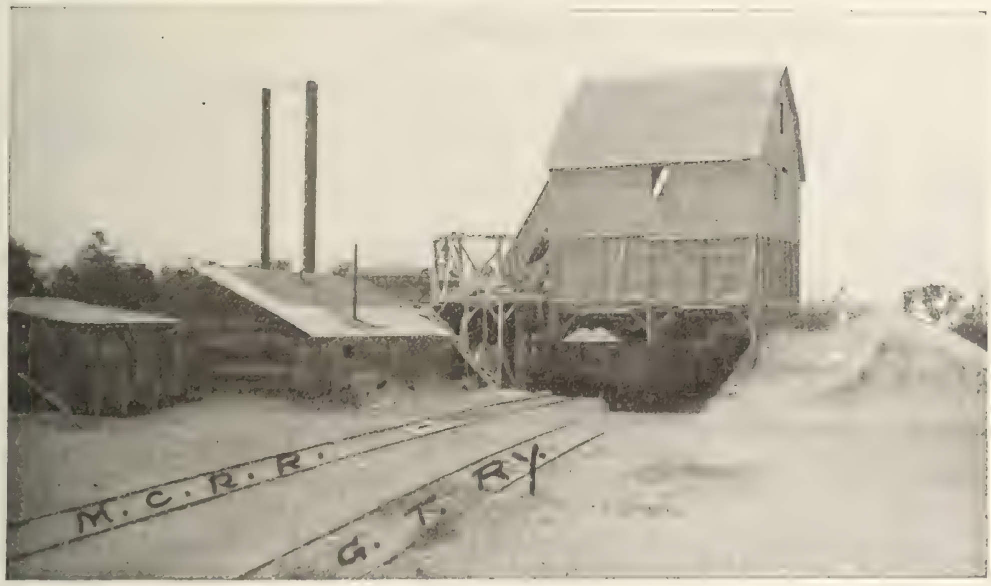
"Ask for special Bulletin."

THE "CHAMPION" LINE OF ROAD, STREET AND CONTRACTORS MACHINERY.
THE "CHAMPION" OIL DISTRIBUTERS FOR DUST PREVENTION OILS, ALSO THE HEAVY ASPHALT AND TAR PROCUCTS FOR ROAD BINDERS.

Manufactured by

American Road Machine Company of Canada, Limited
GODERICH, ONTARIO

Macadam Roads



must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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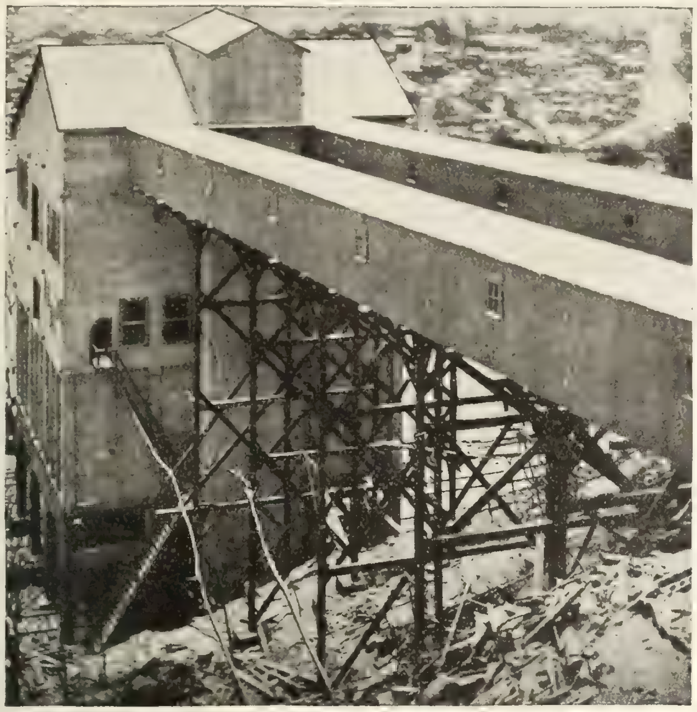

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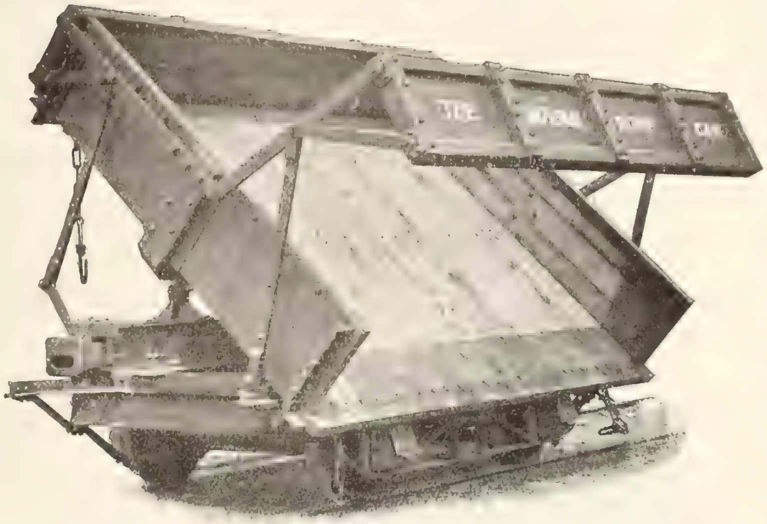

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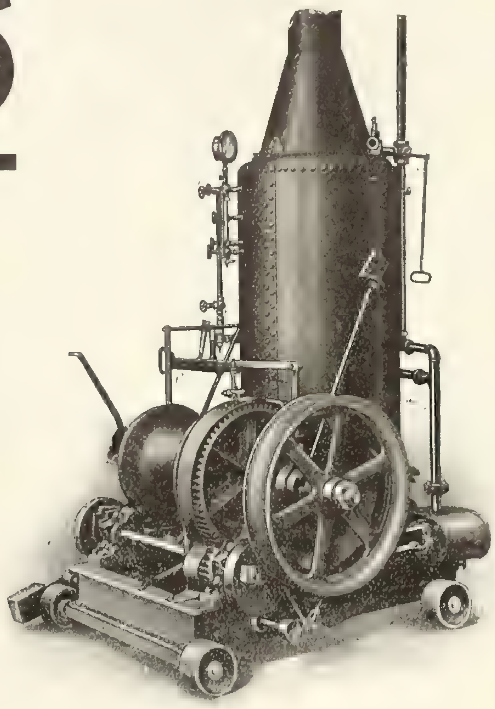

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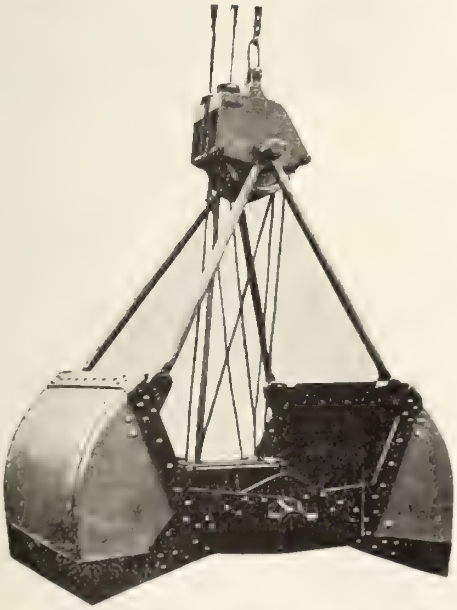

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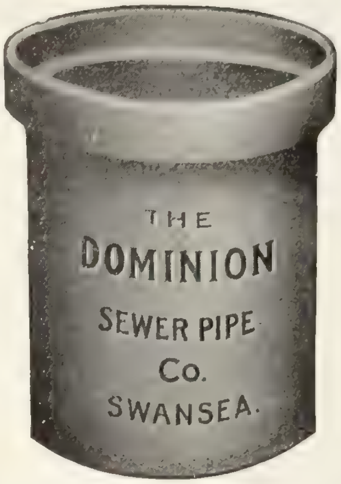

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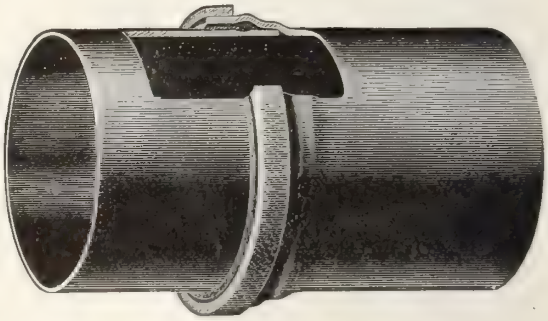

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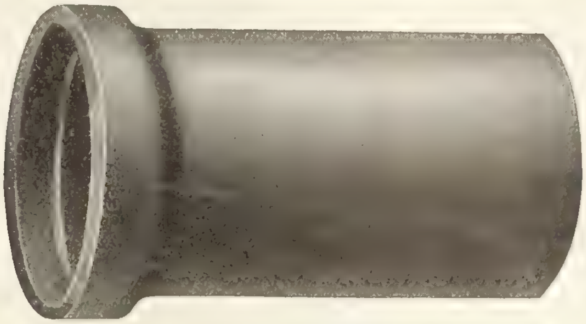

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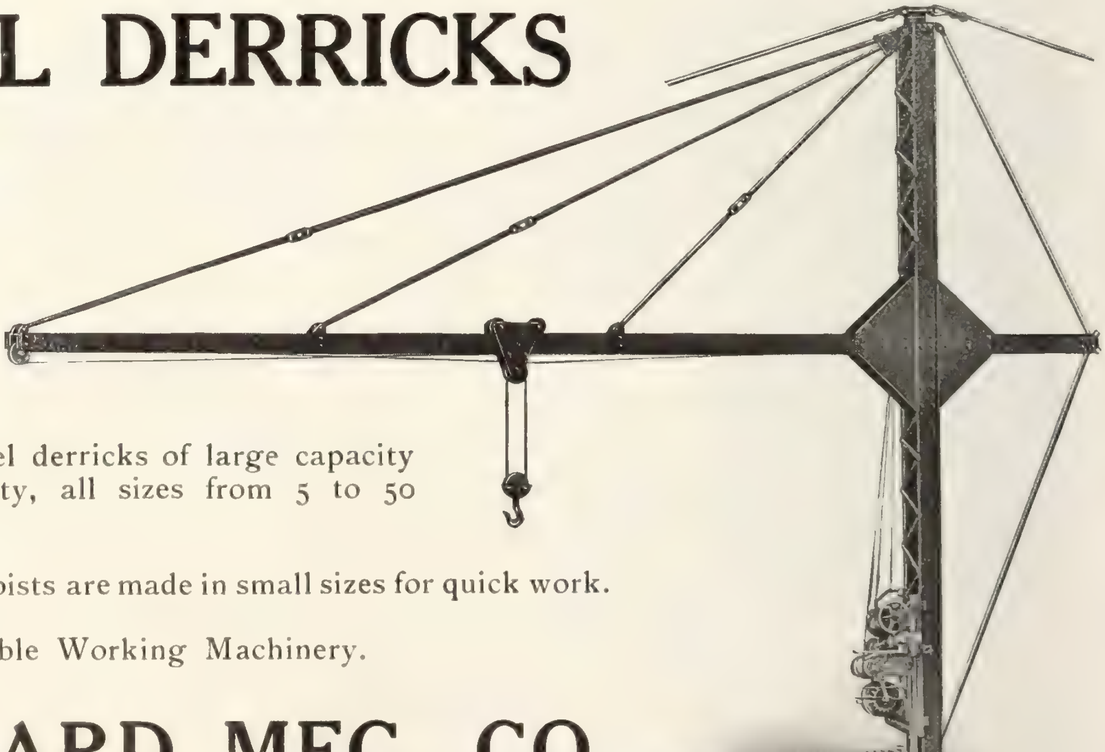

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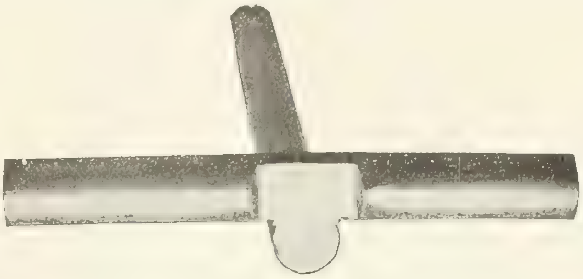

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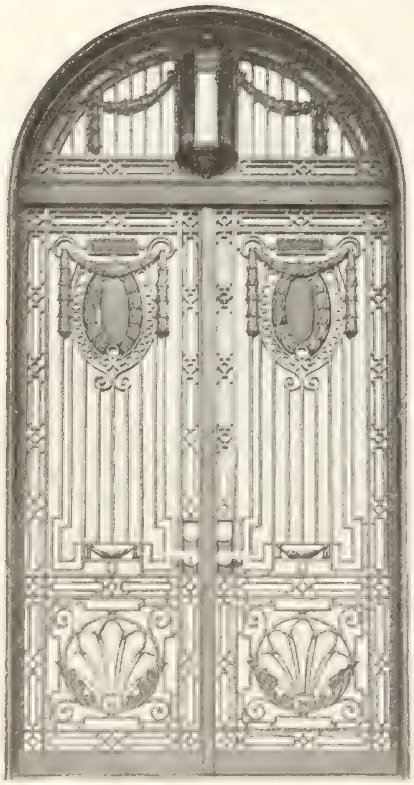

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New Policies in Aqueduct Construction

AN interesting feature of one of the most noteworthy municipal engineering enterprises of a continent is the subject of an article published elsewhere in this issue. We refer to the one-hundred-mile Winnipeg Aqueduct—a work which occupies a unique place in water-works construction by virtue of the unusual conditions under which it will be built. The article is a leading feature of a special Water-works Number published by The Engineering Record of New York.

Our contemporary comments upon the fact that the several municipalities combining to form the Greater Winnipeg Water District have assumed direct responsibility for the selection and transportation to the work of the principal materials of construction. The district has built and will operate its own construction railroad, will purchase all cement directly instead of delegating this duty to the contractor, and will not only supply to the contractors sand and gravel but will also grade this material in the proper proportion for use as concrete aggregate. These three innovations in administrative policy are discussed in the article published on p. 526 of this issue.

Local conditions, of course, had much to do with the approval of this plan for the conduct of the work. The aqueduct line extends through almost impassable swampy country where no transportation facilities were available. Without the railroad it is probable that reasonable bids for construction could not have been secured. The direct purchase of the cement was decided upon to insure sound, waterproof construction. The decision to deliver graded sand and gravel to the contractors was influenced by the difficulty of securing, even in a single pit, material which did not show such wide variations in quality that its direct use by contractors would have entailed an amount and quality of inspection almost impossible of attainment and exceedingly costly. The purchase of cement by a municipality or State is not new and has its counterpart in the buying of bituminous materials for road construction by such State highway departments as those of Massachusetts and California. The large-scale delivery to contractors of graded sand and gravel for concrete, however, is believed to be decidedly novel.

It is clear that under the Winnipeg plan disputes between engineers and contractors regarding the quality of materials will be reduced to a minimum, if not entirely eliminated.

Cum Grano Salis

OF the new uses of concrete there seems to be no end and the latest is in connection with a dummy war fleet which is reported to have sailed to block the Kiel Canal and prevent the German vessels from getting out. It is needless to say that this war strategy could not have been brought to a successful conclusion unless cement were used to fill the holds of the vessels and thus lower them in the water. The plan as described was to take a number of old steamships, bought from the merchant service, including ships like the Campania, Oruba and Orotave, which have been fitted with dummy funnels, wooden turrets and guns, and their holds filled with cement to lower them in the water. This will make them torpedo proof, it is explained, because, owing to the hardness of the cement, a torpedo exploding would only rip off a plate or two in the hull. An outside belting of cement has been added to the hulls of these dummy warships to protect the engines and boilers. The report of a battle between a German torpedo and a dummy ship loaded and belted with concrete is yet to be made, but the result will be awaited with interest!—Concrete Cement Age.

Mr. Edison and the Edison Fire

THOMAS A. Edison has recently sent to the technical press and newspapers a letter in which he calls attention to a campaign against concrete which is being waged by various brick interests, taking the Edison fire as the text. According to Mr. Edison the entire purpose of the publication is to discredit and, if possible, retard the use of reinforced concrete in construction of fireproof buildings. Mr. Edison states that the evident purpose of the publication is to deceive and that it is in error in many ways. His specific criticisms are as follows:

> The results of the fire at my plant on December 9, 1914, are used in an entirely false and misleading manner. Of the seven reinforced-concrete buildings, none was destroyed. A small section of the upper floor of one of the buildings fell in, but was supported by the lower floors. The pamphlet referred to presents three views of this, the suggestion being that they were of three different buildings. The brick administration building to which it refers, which remains standing, was protected by an adjacent concrete building and was not subjected to the fire.
>
> Every brick and steel building which was attacked by the fire was completely destroyed, together with all the machinery they contained, while the damage done to the concrete buildings amounted to about 12½ per cent. and of the machinery contained in the concrete buildings 98 per cent. was saved and is now in operation. Manufacturing was resumed in some of the old concrete buildings within a few weeks after the date of the fire.
>
> Temperatures were far in excess of those in the ordinary fire, but reinforced concrete showed its superiority over any other fire-resisting material.

Contraband Articles

The following articles have been declared by Royal Proclamation to be absolute contraband: Powder and explosives specially prepared for use in war, ingredients of explosives—viz., nitric acid, sulphuric acid, glycerine, acetone, calcium acetate, and all other metallic acetates, sulphur, potassium nitrate, the fractions of the distillation products of coal-tar between benzol and cresol inclusive, aniline, methylaniline, dimethylaniline, ammonium perchlorate, sodium perchlorate, sodium chlorate, barium chlorate, ammonium nitrate, cyanamide, potassium chlorate, calcium nitrate, mercury, resinous products, camphor and turpentine (oil and spirit). Ferro alloys, including ferro-tungsten, ferro-molybdenum, ferro-manganese, ferro-vanadium, ferro-chrome. The following metals: Tungsten, vanadium, molybdenum, nickel, selenium, cobalt, hematite pig iron, manganese. The following ores: Wolframite, scheelite, molybdenite, manganese ore, nickle ore, chrome ore, hematite iron ore, zinc ore, lead ore, bauxite. Aluminium, alumina, and salts of aluminium; antimony, together with the sulphides and oxides of antimony; copper (unwrought and part wrought) and copper wire; lead, pig, sheet or pipe; barbed wire, and implements for fixing and cutting the same. It is further announced that the export of explosives of all kinds is prohibited to all destinations abroad other than British possessions and protectorates.

The War and America

An Old Country Viewpoint given by The London Builder

THE world has changed since the days of the Franco-Prussian War, during which time this country enjoyed a period of unprecedented good trade. Our cousins in America seem, if we may believe newspapers, to be most anxious for peace to come to Europe in order that trade and commerce may follow the normal lines. At least, that is the general impression produced on us, for it may be doubted whether America's warm commendation of the Papal efforts to induce Europe to allow His Holiness to mediate between the opposing parties is altogether inspired by altruistic motives. We are glad to note that Mr. Roosevelt, whose views and methods of electioneering we sometimes disagree with, has spoken with no uncertain voice as to the issues at stake and what should be the American attitude regarding them. We do not need the active participation of America, but it is well to have, and better to retain, her sympathies. The fact is that in the last fifty years finance and commerce have become more internationalized than they ever have been before, and to quote an American writer: "Everything that's done unequal injures all of them the same," and not even the possibility of the exploitation of South America consoles America for the shutting down of European markets. We hope our American cousins will produce great works in the only great country unaffected by the war, and that when we can turn once more with undivided attention to the prosecution of the Arts of Peace, we may find ourselves a "long lap behind," for in these matters we are glad if any country leads, since it is to the benefit of all.

With reference to the asphyxiating gas used by the Germans against our troops and those of our allies, opinions have been expressed by many competent and other people as to its constitution, comments The Engineer (London, Eng.). Thus the military correspondent of a popular halfpenny London daily paper described it as "chloride of sulphur." The special correspondent in Northern France of another London journal suggested it might be "a carbide di-oxide, probably mixed with ammonia." Other suggestions have been chlorine, bromine, sulphur dioxide, nitrogen peroxide, carbon monoxide, and carbonyl chloride. Some of these substances, for example carbonmonoxide, would, by themselves, not account for the appearance of the gas as reported, while others, for example nitrogen peroxide and carbonyl chloride, would probably be too difficult and expensive to prepare. Chlorine certainly seems the likeliest of the lot, but it is, of course, not in the least certain that it was an inorganic substance at all. This leads us to the suggestion which we would commend to the attention of military correspondents and others that, by discharging volumes of ammonia gas in reply to the enemy's chlorine, we could frustrate his knavish tricks and confound his chemistry. The resulting sal-ammoniac could be collected afterwards and used for the trench telephones.

The war is having the effect of raising the prices of all sorts of commodities in Germany. Cement is a case in point. The last price of the material in Hamburg was $1.55 per bbl. of 374 lbs. net, or two sacks of 187 lbs. net. This is an advance of nearly 50 cents per bbl. and is probably due to the large consumption of the material for fortification and trench work.

Direct Control Over Materials a Feature of the Winnipeg Aqueduct

Six Communities, Forming Water District, Build Construction Railroad, Supply All Cement and Deliver to Work Properly Graded Mixture of Sand and Gravel

THREE features of administrative policy combine to give to the work of building the 100-mile aqueduct from Shoal Lake to the city of Winnipeg and adjoining communities which have organized the Greater Winnipeg Water District, a unique position in the history of water-works construction: All materials will be transported by a municipally-owned and operated standard-guage railroad, built especially by the water district to serve the contractors; all cement will be purchased by the district and supplied to the contractors; all sand and gravel will be graded by the district at a large central plant and shipped to the work in the proper proportions for direct delivery to the concrete mixers. Thus, to an unusual degree, will the district have immediate, instead of indirect, control, not only over the delivery, but also over the quality, of the principal materials which will enter into its work.

Essential Parts of Project

The new water supply project, which was recommended in 1913 by a board of consulting engineers, consisting of Rudolph Hering, Frederic P. Stearns and James H. Fuertes, comprises, essentially, a low diversion dam at Indian Bay, an arm of Shoal Lake; 85.036 miles of horseshoe-shaped concrete aqueduct, the largest section of which is 10 ft. 9 ins. wide and 9 ft. high inside; about 10 miles of 5-ft. steel pipe; 900 lin. ft. of tunnel under the Red River, and 12,000 lin. ft. of 4-ft. cast iron pipe leading to the city reservoirs. The conduit is designed for a carrying capacity of 102,000,000 gal. in 24 hours, sufficient, on the basis assumed for a supply throughout the year, for 850,000 inhabitants. In 1913 the population of the Greater Winnipeg Water District was 225,000, of which 200,000 were in the city of Winnipeg. The rapid growth is shown by the fact that the 1913 population was twice that of seven years and five times that of fifteen years previous. The capacity of the aqueduct was based upon the assumption that the daily per capita consumption in some months would be as high as 120 gallons.

Including the railway line, which is about 105 miles long, including sidings, and an item of 15 per cent. for administration, engineering and contingencies, the estimated cost of the work is $13,045,600.

Source of Supply Remote

Winnipeg, like a great many of the smaller communities in the vicinity, is disadvantageously located for securing near at hand a supply of soft water. The ground and river water near by is so hard that it is unsuitable for manufacturing and laundry purposes, and is not very satisfactory for domestic uses. The only suitable water is found in the granite country 100 miles or so to the east and northeast of Winnipeg. This condition made it necessary to construct an aqueduct of unusual length.

Winnipeg is about 760 ft. above sea level and contains no hills on which reservoirs could be advantageously located. The country from which the new water supply is drawn is about 300 ft. higher than the general elevation of the city, and the available slope for the aqueduct, therefore, was only about 3 ft. to the mile. All this head is consumed in delivering the water into the city reservoir.

Greater Winnipeg Water District

Obviously a project involving a 100-mile aqueduct would have been too costly for any one of the smaller towns to undertake, but by combining their resources with those of Winnipeg five other communities will benefit by the new water supply from Shoal Lake. The Greater Winnipeg Water District comprises the municipalities of Winnipeg, St. Boniface, Transcona, St. Vital, Assiniboia, Fort Garry and Kildonan. The powers of the district are vested in an administrative board, consisting of the mayors and reeves of the municipalities, the mayor of Winnipeg acting as chairman. This board decides upon all broad questions of policy, while a commission of three members, two of which have already been appointed by the board, is responsible for the execution of the work in accordance with the board's direction. Matters involving decisions on technical questions are referred to the consulting engineer, James H. Fuertes, of New York City, and the construction work will be directed by the chief engineer, W. G. Chace.

The Construction Railroad

A big problem had to be solved before bids could be advertised—that of transporting materials to the work. In addition to its great length the aqueduct line traverses a swampy country which is well-nigh impassable when the ground is frozen, and it was realized that reasonable bids for the construction of the works could not be secured until means of access to the remote parts could be provided. The district decided, therefore, to open up the territory for construction purposes by building its own railroad and operating the line with its own forces, charging the contractors for the transportation of materials according to a schedule of rates published in advance of the receipt of bids. The route, about 90 miles long, exclusive of sidings, was surveyed, built and placed in service in a single working season, a feat of no mean magnitude considering the character of the country. The line is laid with 60-lb. rails, is well drained and designed for heavy and continuous traffic. It is hoped, on each contract, to maintain a rate of progress sufficient to complete the aqueduct by the fall of 1918, and it was of first importance that no delays in the delivery of materials should be caused by road-bed defects.

The terminus of the line is at Deacon, south and west of Transcona, where the Grand Trunk Pacific shops are located. A station and a storehouse for cement and other freight has been erected at Deacon. Cars of supplies, received from foreign roads, are delivered on the transfer tracks at Paddington, near Winnipeg, and picked up by the district's train crews and unloaded at Deacon or hauled to the work. The road is a single-track line with about ten permanent sidings and spurs, and arrangements have been made to cut the track and put in switches, if necessary, at points where contractors may best be served.

The contractors are arranging their plants on a plan calling for movable wooden platforms to lie lengthwise of the main track and span the railroad ditch. These platforms, upon which the sand and gravel will be dumped direct from the cars, are in units that can be picked up and moved ahead successively as construction progresses. At each camp the contractors will provide storage for cement. At the eastern terminal of the line, at Indian Bay, are yards and storage tracks. The railroad follows the aqueduct line closely for almost it entire length.

Cement Supplied to Contractor

The district's policy of supplying cement to the contractor, instead of allowing him to purchase this material, was adopted primarily in the interests of sound construction. The cement is delivered to the contractor at its cost to the district. Each contractor is charged for all cement supplied to him and is credited for the actual amount that goes into the work, as reported by the district's inspectors. In order to avoid disputes as to the quality of cement in case of defective work the contractor is constituted an inspector and is given all powers pertaining thereto. The cement will be inspected at the bins of the plant where it is manufactured. As soon as they are filled the bins will be sealed and the cement will be released only by the district's inspectors. It will then be shipped in sealed cars to the work or to the storehouse at Deacon. Accurate records of all cement leaving the mill will be kept, and no cement will be released until the tests have shown that it fulfills the requirements of the specifications. Several of the contractors have joined in employing an inspection bureau to check the district's tests.

The concrete aqueduct section has a width of 10 ft. 9 ins. and a height of 9 ft. inside.

Samples to be tested are collected automatically at a rate of 1 oz. per minute as the cement enters the bins at the mill. These samples will be divided among the inspectors for the district and for the contractors.

Grading of Sand and Gravel

Except for a few miles at its western end the aqueduct is of concrete for its entire length. Great stress was laid upon the requirement that materials and methods be such as to produce uniform, water-tight work. This result depends, to a large extent, upon the use of sand and gravel of suitable quality and proper grading. This responsibility the district also has assumed, instead of leaving it to the contractors, and will supply all the sand and gravel used throughout the work in properly graded mixtures made up at a large central screening plant at the district's gravel pit at about mile 30. Local conditions made this precaution necessary for the sand and gravel obtainable in the vicinity of Winnipeg varies widely in quality. It is a glacial deposit, in which the strata are not uniform, due to outwash in ancient times. The deposits are found in various locations over the whole length of the aqueduct line, and vary in depth and in their character of stratification, as to sizes of particles. Under such conditions to have given the contractors free rein in getting their own sand and gravel would have required a standard of excellence of inspection which would have been impossible of attainment and exceedingly costly, and would have resulted in the production of concrete containing too much sand or too much stone—in other words a porous concrete which it was essential to avoid. The district, therefore, decided to supply the contractor with sand and gravel mixed ready for use, and to this end secured extensive gravel deposits which were selected after thorough and careful inspection by test borings and careful mechanical analyses of samples of the strata made at the district's laboratory in Winnipeg.

The aim has been to obtain a thorough knowledge of the locations where coarse material predominates, where fine material is to be found and where material of an intermediate character exists. It will then be attempted to work with steam shovels through the different deposits in such directions and to such depths as will give a raw material necessary for a proper aggregate with as little waste as possible. With this in formation in hand it is expected that there will be not over 5 per cent. waste in the material collected by the shovel.

Central Screening Plant

The steam shovels will load into dump cars at the gravel bins and the cars will be hauled in trains to a central screening and mixing plant, where the raw material will be discharged upon inclined screen bars which will intercept any excessively large sizes. The material passing these bars will be raised by elevators to revolving screens and separated into four sizes —fine, intermediate, coarse and over-size. The over-size pieces will go to a crusher and thence again to the revolving screen. The material is sufficiently clean to obviate the necessity of washing.

The screened material will drop into three bins each provided with a spout in the bottom discharging on to a separate endless belt. These three belts deliver to a third belt running at right angles to them and leading to the storage bins. The fine, intermediate and coarse material is made to discharge on the conveyor belts at predetermined rates based analyses and inspection, so that the material as it enters the storage bin is properly graded.

Studies of samples from different pits indicate that there will probably be an excess of fine material, basing the proportionate amount of intermediate and fine upon the amount of coarse, and that if a definite mix of the three sizes were determined upon there would be a considerable waste of material. Laboratory investigations indicate, however, that by making use of some of the extremely fine sand, which would ordinarily be wasted, a very dense concrete can be produced with practically no waste. In such cases the coarser material serves simply as pudding stones. This concrete, in which the fine material has been used, has been found to flow easily and be water-tight.

The district has established a laboratory for concrete tests at headquarters in Winnipeg. Large specimens for crushing are, through the courtesy of the Engineering Department, tested in the laboratory of the University of Manitoba. Here 8-in. concrete cylinders are broken by compression, using various mixtures of fine, intermediate and coarse gravel; blocks are subjected to permeability tests in the district's laboratory.

Delivery of Graded Material

From the storage bins at the central plant the properly proportioned mixture of sand and gravel will discharge into trains of air-dump cars which will be hauled to the work and dumped upon the wooden platform along the aqueduct trench, previously referred to. The contractors will take the sand and gravel from the platform, working at right angles to the track so as to prevent any segregation of material. Experience may show that segregation may occur to a small extent during transportation, or that some of the fine material will be lost through cracks in the cars. If so, arrangements to ship out extra sand, as may be necessary, will be made.

Construction Methods to Be Uniform

The aqueduct has been divided into five contract sections, awarded to three contractors. In order that uniform methods may be followed on each section of the work all of the contractors have arranged to secure one type of form from the Blaw Steel Construction Company, thus systematizing methods of concreting throughout the entire job. The inside aqueduct forms will be collapsible and plans have been formulated for handling the work in such a way as to permit continuous progress both on straight portions and on curves.

A very important construction feature will be the use of straight sections of forms on curved portions of the aqueduct. The curved alignment will, in reality, be a series of tangents of 15-ft. lengths; at the gaps in the forms where these angles occur wood fillers will be used. All of the curves in the alignment have the same radius, 50 ft., and no curve will require more than three 15-ft. sections of form. On each section of each contract it is planned to make the concreting progress 90 ft. daily.

The schedule of work laid out for the year 1915 is shown in the table below.

The chairman of the administration board of the Greater Winnipeg Water District is Mr. R. D. Waugh, Mayor of Winnipeg. The two commissioners are Mr. S. H. Reynolds, C.E., chairman, and Mr. James H. Ashdown, who was Mayor of Winnipeg when the water question was investigated in 1907. To Mr. Thomas R. Deacon, C.E., President of the Canadian Club of Winnipeg, and former Mayor of the city, is due much of the credit for making a reality of the water supply project for the district. It was under his administration that the project took definite shape, that the Greater Winnipeg Water District was organized, that the surveys were made, the railway built and the contracts for the construction of the aqueduct awarded.

Contract No.	Contractor	Length in Feet
30	J. H. Tremblay Company, Limited	20,600
31	Thos. Kelly & Sons	27,000
32	Winnipeg Aqueduct Construction Company ...	32,660
33	Winnipeg Aqueduct Construction Company ..	21,020
34	Winnipeg Aqueduct Construction Company ..	10,800

Mr. W. G. Chace is Chief Engineer of the work and Mr. James H. Fuertes, of New York, is Consulting Engineer.

An article dealing with the methods and cost of making test borings for the Winnipeg Shoal Lake Aqueduct was published in our issue of April 21st last. For the information published herewith we are indebted to The Engineering Record, of New York City.

The Proper Method of Mixing Concrete

It is no doubt almost an accepted principle among contractors that the order of placing concrete material in a mixer is of no importance. Occasionally a specification is written, and more rarely followed, under which it is required that the component parts of the concrete be placed in the mixer in some prescribed order; but the general practice is to throw in the cement, aggregate and water in any convenient order, or, in case a measuring hopper is employed, all at once. In hand-mixing, of course, the old practice of first mixing the dry sand and cement still prevails, but that is because when all the materials are thrown on the board together and doused with water it is difficult to get men to turn over the mass of wet concrete long enough to insure a well-mixed mortar, says a writer in Concrete Age. The stronger and more efficient machine is thought to remove this difficulty.

Cause of Density of Concrete

Some pressure tests on concrete pipe were made recently by a company attributing the density of the concrete obtained—first, to its richness—a 1:1½:2½ mix being used—and, second, to the method of mixing with especial attention paid to the order of placing the materials in the mixer.

According to the method used, the mixer is first charged with the proper amount of water (established by experience and observation), and into that the cement is dumped; the mixer is then turned until a well-mixed grout results. Into this is dumped the stone, and after this has been turned sufficiently to insure the coating of all the stone particles the sand is put in and the turning continued until the sand particles are well covered and have apparently filled all the voids in the cement-coated stone.

It may be that the users of this method are correct in their assumption that the order of placing is responsible for the exceptionally dense concrete which they achieve, but others think that the effectiveness of the method is due not so much to the order of placing the materials as to the length of time taken between placing the separate components, which added together make the total length of time of mixing somewhat longer than in the normal mixing of concrete.

This naturally leads to the query, "Is enough attention paid to the length of time of mixing in machine-mixed concrete?" Are not most contractors too hasty in getting the batch out of the mixer? A piece of western construction is reported in which it is stated that 2,150 cubic yards of concrete were mixed in an eight-hour day in four one-yard mixers. This is somewhat more than one mix a minute for each machine. Regardless of the type of machine used, would not a two-minute period give a concrete sufficiently better to warrant the use of more machines, with their additional cost of purchase and operation?

As construction is now generally carried on the time of mixing is governed entirely by the observing eye of an inspector or superintendent. When it seems to him that the various parts that go to make up the concrete have reached a proper intermingling the batch is dumped. If it is a fact that after a certain amount of mixing, easily determined by the expert eye, the component parts of the concrete become so thoroughly intermixed that no perceptible increase in quality of the concrete will result from further mixing, this method of ocular inspection is correct enough, but if it is probable that an increase, even slight, in future strength may result from mixing the concrete beyond the time when it seems to be thoroughly mixed, then in the scientific development of concrete construction such time should be ascertained.

We believe that some tests have been carried on to investigate the proper time of mixing concrete, but these tests have not been so conclusive nor have they had such wide publicity as to be of much value. There is a field here for future investigation, which some testing laboratories should take up soon. Undoubtedly most of the concrete which is made is mixed in too short a time. If by adding to that time we can increase the density of the concrete, and thus improve its water-resisting qualities or prolong its future life, we are certainly justified in the additional expense of extra mixing. It may be difficult to estimate precisely the effect of this additional mixing, but unless there is absolute certainty that it does no good it would be at least a good insurance. The difficulty, of course, is not in determining whether additional mixing is desirable, but in ascertaining some method by which the exact time of increased mixing may be rationally determined, and that is the field of the testing engineer.

Economics of Concrete Construction

By DeWitt V. Moore

CONCRETE is a peculiar building material in that it is manufactured on the job, whereas stone, brick, steel and wood are delivered on the site ready for the structure. The cost of stone as delivered is determined by its quality and hardness and by the distance of transportation and the cost of quarrying and dressing. The cost of the brick is determined by the quality of the clay from which it is produced, the method of transportation, and also by the cost of labor to handle, sort, and select. The cost of steel is more nearly consistent; but even this material is affected by the character of the material, the shapes into which it is rolled, the sizes of such shapes, and the distance of transportation. The cost of timber is likewise affected by the character of the wood, the size of the pieces, the grade and the distance of transportation.

In all of the foregoing standard building materials, no man would think of bidding without first ascertaining what was required, and then obtaining a price from those who were qualified to furnish the specified material. In the case of concrete, it would appear that the elements entering into its construction are in most cases entirely overlooked—that concrete is treated in the estimate without any regard to the varying character of the materials and proportions entering into it. This is not as true now as it was a few years ago; but it is still true in a great many proposals.

Selection of Gravel or Stone.—Most specifications allow either gravel or stone to be used. Where good gravel can be obtained, it is preferable to stone from a cost standpoint, and it is more easily handled throughout the entire operation of mixing and placing. Broken stone is usually obtained from quarries, and must be transported by railroad cars, unloaded by hand, and then hauled to the location of the work. Gravel, on the other hand, when loaded, is hauled directly to the site of the work. From a cost standpoint, therefore, we have two reasons why gravel is preferable: (1) Under ordinary conditions there is less manual labor connected with its delivery; (2) there is less cost for manual labor due to the nature of the material—a laborer can shovel approximately twenty per cent. more gravel than stone under the same conditions.

If the gravel is good, the resulting work is equal to or better than broken stone concrete. A good gravel for concrete should be of varying sizes wherein the size of the pebbles ranges downward from, say, 2½ inches to ¼ inch. The proportions of sizes should be such that there is approximately fifty per cent. of each size with reference to the next largest. Concrete made of such materials will be homogeneous, dense and of great strength. Either gravel or stone should be watched very carefully for foreign materials, such as lumps of clay from stripping the hardpan strata, sticks, decayed material, etc. So-called yellow gravel is not necessarily a sign of weakness, although such a deposit should be examined carefully. In many cases such a surface discoloration is caused by leachings from deposits of strata of oxide of iron or other materials.

Selection of Sand.—Much that has been said about gravel is true of sand, except that sand is more important, in a sense, than gravel. Sand should be relatively clean and of varying-sized grains. Such a sand is much better than when of even-sized particles, and I think I am safe in saying that silt up to five per cent. will not affect the strength of the resulting concrete. If, however, sand is silty to any such extent, care must be taken that the work is cleaned every morning (this same remark applies to the gravel); for if this is not done, there will arise to the surface of each day's work a soft, slimy substance which has no strength and which will form strata of demarcation between the successive courses. Other things being equal, it is better to import sand at an increased cost, using local gravel, than to use local sand and import gravel and stone.

Selection of Cement.—At the present time there are so many brands of Portland cement of recognized value that as far as quality and ability to withstand tests are concerned there is little choice. When it comes to large and important work, however, it is well to consider the capacity of the plant and be sure of its ability to deliver the cement on time and in the quantity required.

Selection of Machinery.—Various types of work naturally demand various types of machinery and arrangement, but in general it may be said that a small mixer is not economical. Use nothing smaller than an 18 cu. ft. mixer, which will deliver ½ cu. yd. of mixed concrete, and use a larger mixer than this if the work will justify it. Also in general it may be stated that each batch from the mixer should be handled as a whole as nearly as possible to the place of deposit. The wheelbarrow is no longer the primary method of transportation of concrete. There is no doubt as to the consensus of opinion being in favor of batch mixers; but whatever the type adopted, it will be well in the long run to install 20 to 25 per cent. more boiler and machine power than is specified by the manufacturer.

When Hand Mixing is Justified.—Hand mixing cannot be expected to be as uniform as machine mixing; and yet, if proper care is taken under intelligent supervision, good results can be secured. From the standpoint of cost hand mixing is preferable when the work is so small as not to justify the installation of a machine. For instance, on a job of a couple of hundred cubic yards probably $100 would be expended in installing and rigging the mixer, or a cost of 50 cents per cubic yard; and it is doubtful if hand mixing would cost any more than this difference. Again, hand mixing is preferable in connection with large work where, in order to reach isolated portions of the work, it is more economical to mix by hand than to wheel long distances. Hand mixing is most important when constructing floors, sidewalks and pavements on a natural gravel foundation where it is possible to shovel material directly upon the opposite side. Under no circumstances can machine mixing compare in cost with this method where conditions will permit of its use.

Mixing Concrete.—For ordinary work concrete should be mixed wet, soupy. From the standpoint of quality, care of handling and manipulation, resulting finish and cost of surfacing, there is absolutely no question as to this point. This choice of wet concrete applies to walls, bridges, reinforced concrete buildings, etc., but for sidewalks and pavements economy demands a dry mixture requiring tamping in order that the workmen applying the finish may follow as quickly as possible after the depositing of the concrete.

Placing Concrete.—No concrete should be placed until it is definitely determined that the forms are correct and properly braced. It is cheaper to delay the work than to cut out work already done. Concrete should be placed as quickly as possible after mixing, and not be disturbed afterwards. When being placed it is abused to the greatest extent. We take great care of a green brick wall, but do not hesitate to walk over and conduct operations over concrete which has not reached its final set, thereby destroying the surface of the concrete for all time. While this may not be serious in some cases, it is certainly not desirable in thin concrete slabs. Concrete is better placed by chutes than by wheelbarrows, cars, etc., for the reason that, by chuting, the material is kept constantly in the process of mixing until it is deposited in the work. With barrows or carts the heavier particles settle to the bottom, and when the mixture is dumped into the work there is a separation. Chuting also allows the placing of the concrete with a minimum of working back and forth over the work just completed.

The ideal condition would be the completion of the work without interruption; but, as this cannot be attained, care should be taken in the location of and in the manner of constructing the connection joints as the work progresses. Breaks should be made preferably at the centre of columns transverse of girders. Slab spans may be joined longitudinally over centres of girders or beams, but this method should be considered a second choice. Columns should not be poured all at one time. Generally a height of 4 ft. should be allowed to set for three or four hours before the second pouring. Slabs, girders, and beams should be poured continuously up to the determined joint where stop forms have been placed. The method of pouring girders up to the bottom of the slab, and then afterwards placing the slab, is not desirable. The method of pouring a slab and allowing the material to slope down over the girder, and then beginning the next day, gives a slip-slab joint which cannot be recommended. In all concrete work stops should be made on horizontal and perpendicular lines at the locations mentioned, the forms being carefully placed.

Finish of Concrete.—We are wrong in our present practice of finishing concrete surfaces. The surface finish of a piece of concrete should be an integral part of the main construction, and of the same mixture and same composition. The time was when we were called upon to plaster and apply a surface coat to vertical surfaces. After a good many years of argument by the practical concrete workman, we have reached a point where such surfaces are finished generally by spading, so as to bring the finer particles to the surface and force the large particles back so that they are not exposed. We are, however, following the old practice in respect to horizontal surfaces, applying a thin coating of rich mixture on top of our cheaper concrete base. In order to secure the best results we should so manipulate our concrete as to bring our finish to the surface from the material of the concrete base. When we reach this point we shall have less trouble with checking, insufficient bond, and so on, and such a finish can be obtained easily by the use of proper tools for tamping.

Construction of Forms and Centres.—If there is one element entering into the cost of concrete which is neglected, it is the cost of forms and centres. So far as is known to the writer, no architect or engineer ever submits to a bidder a plan for this part of the construction. Even the specifications are vague and indefinite, leaving it to the individual contractor to plan his own work. Some go to one extreme, and use a great deal more timber than is necessary; others to the other extreme, and use so little and of such light construction that the work is out of line and out of plumb. When it is considered that the cost of forms and centres represents from 20 to 33 1/3 per cent. of the cost of every cubic yard of concrete placed, under average conditions, it is hard to understand why the subject is not given more consideration.

Ordinarily it is left to the carpenter boss to put up something by rule of thumb and by his judgment based on past experience. There is nothing practical about such a method. The designs for the forms of any structure should be planned carefully to accomplish the results with a minimum of material and labor, giving due consideration to the maximum amount of salvage in the material. It is our contention that, accompanying the plans for any structure, there should be prepared by the engineer and architect a sheet detail drawing showing how forms should be constructed, thereby insuring quality of workmanship and placing all bidders upon the same basis. If this is done there is nothing to hinder any contractor from submitting an alternate design.

Types of Reinforcement.—Types of reinforcement now on the market may be classified as follows: (1) Plain bars, either medium or high-carbon steel; (2' plain bars, deformed or cold-worked to secure deformation (this classification includes cold-twisted and hot-twisted square bars); (3) special patented types of plain or deformed patented bars; (4) built-up bars—meaning thereby combination of various-sized members in order to utilize the quantity of steel to the best advantage; (5) built-up frames composed of bars of various sizes, generally used for beams, girders, and columns; (6) floor-slab reinforcement of sheet metal, sheared, punched, or expanded in order to distribute the steel through the mass, and delivered in sheets; (7) cold-woven wire similar to fencing material, delivered in rolls; (8) secondary reinforcement in the way of hoops or bands for columns, stirrups for beams, and spacers for rods, all of which may be made of hoop iron or wire.

Selection of Reinforcement.—Considering the various types of reinforcement just mentioned and the many modifications now on the market, it is a difficult proposition to select the best; and generally the selection is determined by the price submitted by the commercial engineers bidding under sub-contract to furnish the metal. To a certain extent this method is dangerous, but it is hard to suggest a remedy. Individual preference and experience are always a very large element.

Placing Reinforcement.—The design of a concrete structure contemplates the placing of the reinforcement in exactly the position shown by the plans and cross-sections of the various members. Designers are usually quite conservative in their allowance for the protection of steel by fireproofing the concrete below it; and the contractor had better err on the safe side and take advantage of this allowance, rather than keep above same. Often reinforcement—and especially light bars, expanded metal, and wire fabric—are laid upon the forms, and then afterwards manipulated by a hook as the concrete is placed, jerking the reinforcement upward so that the concrete may flow underneath. This is dangerous, inasmuch as there is no gauge to determine the final position of the reinforcement; and if the concrete flows under the reinforcement in too large a quantity it is almost impossible to replace the reinforcement without rebuilding the entire work.

Automatic spacers and devices for the accurate placing of the steel are readily obtainable, and should be used. Naturally there is some increase of cost due to such a method—but it is money well expended. Special care should be taken in placing steel in girders and beams to distribute and arrange the bars so that each individual part may be incorporated within an individual part of the concrete. The reinforcement for columns should be accurately made, and wired with the hoops and stirrups in place before it is erected in place ready to build the column forms around it. While good results can be secured from bar reinforcement, the author at this time is in favor of built-up columns of light structural shapes, for the reason that the integrity of the whole building depends upon the column construction, and a failure of any one column is liable to result in a failure of the entire building. Perhaps the most important reinforcing detail in respect to proper placing is top reinforcement or reverse flexure bars. No matter what the designer may have in mind in theory, or how these bars are proportioned with reference to the main reinforcement at the centre of the slab or beam, it is absolutely essential that these top bars be placed accurately and that they be not disturbed afterwards. This is easier said than done. The main reinforcement is embedded in the solid concrete below the surface, and is protected from disturbance. The top reinforcement is close to the surface, where it is affected by the future operations, and also where the free ends project in case of a break at the joints in the progress of the work. These free ends, if jarred, will often break the bond of the half-bar extending into the work. The placing of loose stirrups is a task requiring very careful supervision; and this is one of the strong arguments for built-up sections wherein the stirrup shear members are rigidly connected. Finally, the employment of an expert mechanic or steel worker at increased wages over common labor is justified by the importance of this part of the work.

Proportions of Concrete.—It is very usual to specify 1:2½:5 or 1:3:6 for the proportions of cement, sand, and gravel for plain or monolithic concrete work; and the usual specification for reinforced concrete is 1 part cement, 2 parts sand, and 4 parts gravel, although some engineers specify a richer mixture for columns. Inasmuch as there still exists a general ignorance on this point whereby these specifications are understood as being 1:7½ or 1:9 or 1:6 respectively, it would seem best that the specifications should read that a mortar should be mixed of one part of cement to so many parts of sand, and this mortar should then be mixed with so many parts of the aggregate.

Proportions of Concrete for Strength.—The ideal mixture of concrete assumes that the aggregate and mortar are mixed in such proportions that the most dense, solid, and homogeneous mass is secured. This result may be secured by expert engineering supervision, but in reality the good common sense of the expert concrete laborer may be depended upon. The artisan who is accustomed to handle concrete can determine, by the appearance of the concrete mixture and by working the mixture, whether he is securing the best results; and, after a long experience, the author is inclined to say that he would just as soon trust a practical common-sense laborer's opinion as base his work upon the report of a so-called expert engineer.

Proportions of Concrete for the Cost.—If a 1:2:6 mixture will satisfy the necessary strength required for construction, there is no necessity of specifying a 1:2:4 mixture, inasmuch as the first mixture will require approximately 1 bbl. per cubic yard, while the latter will require 1½ bbls.—a difference of at least 50 cents per cubic yard in actual cost. In many cases for footings and monolithic work, ¾ bbl. per cubic yard of concrete is all that is necessary. Why specify a rich mixture when one with a less amount of cement will answer the purpose? If the contractor is at all skilled in estimating, the extra cost will be included in his proposal.

Estimating after Proper Analysis.—No proposals should be made upon a concrete job until a proper analysis has been made of all the elements entering into the construction. It is not sufficient to say or to guess that the cost of a cubic yard is so much, but, instead, an analysis should be made of the cost of a cubic yard of concrete under the conditions specified. There are a great many elements entering into the cost determined by such an estimate, which will be stated briefly in the following:

Cost of Materials.—Whether the concrete is to be made of a natural mixture of gravel, or of stone and sand in various proportions, determines the cost of the aggregate. The amount of cement depends upon the proportions of the concrete, as also do the amounts of gravel, stone, and sand. The cost of water for proper manipulation should not be overlooked. In cities the cost of water is determined by rates of 9 or 10 cents per cubic yard. Outside of cities the cost depends upon the labor necessary to secure the water.

Cost Affected by Locality.—Concrete work remote from populous centres cannot be done at the same price as that close to such centres, unless the work is so remote that a permanent camp can be constructed and the laborers held by the very remoteness of the work. Work that is at some distance from the point of supply must bear a charge for the transportation, handling, and hauling of raw materials. This is a labor charge which is chargeable to material, inasmuch as the materials should be considered as f.o.b. the job; but nevertheless, the cost is increased per cubic yard in the proposal.

Cost Affected by Character of Labor and Character of Work.—Good American labor will accomplish at least fifty per cent. more a day than foreign labor. American labor, however, is scarce and preferential. American labor differentiates between clean-cut concrete work under favorable conditions and concrete work under adverse conditions, excessive water, and other disadvantages. The same work may cost a great deal more when built under unfavorable conditions than when built in town.

Cost of Work as Affected by Forms.—A wall of concrete 27 ft. thick may be retained by the same foms and the same amount of form labor as are necessary for a wall 1 ft. thick. In the latter case the cost per cubic yard of concrete is 27 times as great. It is not safe, therefore, to estimate the cost of forms on a basis of guess price per cubic yard of concrete. Each individual job should be estimated for the amount of timber work as carefully as for any other item. It does not matter whether the cost is estimated on the basis of floor foot or concrete surface or upon a basis of feet board measure of lumber; the result is the same, inasmuch as this important branch of concrete construction receives individual consideration.

Cost of Work as Affected by Centres.—There seems to be a misunderstanding as to the separation of forms and centres. Properly speaking, forms consist of the timber work to form those members of concrete construction, such as columns, girders, etc., which must possess a certain regularity of form and evenness of outline. Centres, properly speaking, consist of timber supports for floor-slabs, bridge centres, etc. Where the great amount of labor on timber work is expended solely for the purpose of supporting the mass at a uniform or definite height the unit cost is much less than for forming for individual members.

Cost of Work as Affected by Reinforcement.—Fabricated reinforcement will cost much more delivered to the job than loose bars, but, on the other hand, will cost much less to place in position. It is needless to say that a job where reinforcement is made up of small bars less than ¾ inch will cost much more a ton for labor than for large sections. Good judgment must prevail in this particular. It is very seldom that an estimate will be made based on the labor and the tonnage of each size bar. Rather it is the practice to strike an average labor price in harmony with the class of work to be encountered with reference to the different sizes of reinforcement. It is well to remember, however, that it takes practically as long for the steel man to place and wire a ⅜-inch bar as a ¾-inch bar, while the tonnage is only one-fourth as great; and this point should be kept in mind in making an estimate.

Cost of Work as Affected by General Charge Items.—There are a great many items of the cost of concrete work which are not included in the cost of materials, labor, forms, centres, reinforcement, etc. These costs consist of installing and removing machinery, coal, oil, repairs and fittings to machinery, general charge items such as rope and bolts, and the loss on petty tools such as shovels. Such costs may be determined on the basis of so much a cubic yard; or, preferably, they may be determined on the percentage of labor on different classes of work. No matter what the method of determination, the costs are real expenses, and are as justly chargeable as those for the gravel or cement entering into the work.

Summarized Detail Estimate of the Cost of One Yard of Concrete.—In line with the foregoing remarks and the importance of the detail study of concrete, we submit the estimate for a cubic yard of concrete which according to specifications should be of a 1:2:4 mixture to be used for purposes of building construction; and making these estimates, we desire to lay emphasis on the fact that no two jobs cost the same when itemized in this way:

0.9 cu. yd. gravel at $1.20	$ 1.08
0.45 cu. yd. sand at $1.00	.45
1½ bbls. of cement at $1.20	1.80
Water	10
200 ft. B.M. of lumber at $20 used four times at 20 per cent. less each time used, less 40 per cent. salvage.	1.08
Reinforcement, 150 lbs. per cu. yd. at 2½ cents	3.75
Total cost of material	$ 8.26
Labor centres 120 ft. at $20	2.40
Labor forms, 80 ft. B.M. at $30	2.40
Labor reinforcement, 150 lbs. at 1½ cents	.75
Total labor	$ 7.55
General charge items, proportion of labor 15 per cent.	$ 1.13
Total actual cost 1 cu. yd. concrete	$16.94

Each individual job that is encountered should be estimated in this same manner. It might not be necessary to throw the cost of forms and centres, reinforcement, etc., into the cost per cubic yard of concrete; but however the estimate is made, it should consider all these items, and in the end the result will be the same. If, in addition, there is to be applied a surface coat of finish, its cost must be added.

If there is only one item which adds to the cost, it is the form and centre work. For instance, in the detail estimate just given the cost of lumber and form and centre labor is $5.88. If the work had been twice as heavy, the cost of this labor would only have been half as much a cubic yard. This should bring home to every estimator the importance of dealing with the temporary structural timber work as a separate unit. Personally the writer would rather guess at the amount of reinforcement per cubic yard than guess at the cost of forms and centres. The cost of labor is dependent upon the amount of concrete placed on the square foot of area of work covered, inasmuch as the cost of placing depends upon the distance travelled and the amount handled. The greater the distance, the less the quantity and the more cost per unit; and the less the haul, the greater the mass and the less the cost per unit. Such labor cost may reach anywhere to $5 a yard; and it is suggested that a careful study be given each job to determine the amount of foot-pounds of work necessary to complete it.

Cost Records and Cost Accounting.—It is suggested and recommended that each separate and distinct job should be given a detail cost recording in line with the foregoing, in order that future work may be estimated properly. It is a very simple matter to arrange a cost record book with a system of time reports, so that such records may be obtained and recorded without increase in labor or cost.

Contractors and the Public.—During the last few years much has been written on the standing and relation of contractors to public officials, to engineers and to parties that let work to contract, but little if anything has been written as to the standing of contractors in their relation to the public. Contractors and the public should be closely allied, especially as regards public work.

For the construction of public structures contractors play an important part. It has been through them that many millions of dollars have been saved in the United States and Canada to the taxpayers, the public. This has been due to the fact that not only have the contractors done work better, but also much cheaper, than that done by the day labor method. For this reason there should be a close bond between contractors and the public, as the cheaper work is done the smaller will be a citizen's taxes. This is also the case when better work is done, as if a structure serves its purpose longer less money will have to be raised to maintain and renew it. This is especially true of road and street work. Thus the contractor is a real friend to the public—hardly a philanthropist, for he in turn is paid for his work, but if the contract system were done away with in America taxes would be bound to be higher.

Unfortunately the ideal relations that should exist between contractors and the public do not exist, and contractors are looked upon, to a great extent, as grafters. This has been due to a number of causes.

First, contractors themselves have been to blame, not so much to-day, but in the past. It has been a prevalent idea that public money was legitimate prey to any one. The farmer felt that work on the country roads should be done by him, as in this way he worked out his tax, or got back part of the money he had so paid. He was not very zealous in doing his work. To stop and talk for half an hour did not worry him, as he felt he was partly his own boss, and it was not any one's business if he did waste his time. The man working for a city is wasteful of materials and thinks nothing of loafing, for he says, "the city is rich." Thus it was common, not only for these people, but also for contractors, to think the public treasury was there to be looted, and combines and deals were made to parcel out contracts. This idea was strong, and the public has learned that it much suffer in consequence, so that to-day more is demanded of those who work for the public.

Then contractors have been blackmailed by politicians and dishonest public officials so that they have been compelled to give up some of their profits to these men. This still goes on in some cases, but there is a demand from the public that it should cease and the practice is not as prevalent as it once was.

These things have caused the public to distrust contractors and to believe that they have made fabulous fortunes on public contracts, and the daily papers have added to this belief by publishing sensational articles and cartoons of contractors looting the public treasury. In most cases contractors have been more sinned against than sinning.

A contractor is viewed by the public as being a sharp, shrewd man living on the public, making exorbitant profits on his work, and being the friend of public officials and politicians. Because of his supposed wealth the contractor is respected somewhat, and even held in awe, and the public is always interested in him and his doings. This was shown in the case of James B. McDonald, the contractor at the head of the company that built the first subway in New York. His name was known to nearly every man in the city. He was looked upon as a genius, as a multimillionaire. The name of the engineer who planned and supervised the construction of the subways was hardly known to the public, and the financiers who backed the contractor and made his work possible were given scant notice. This contractor was an able man, but he only followed the engineers' plans and instructions; and sub-contractors, many of whom were unknown to the public, did the actual construction. Mr. McDonald was not a wealthy man, and the greater part of the profits made on the subway were tied up in litigation and ultimately went to his backers. Yet his work placed him at the head of the contracting profession in New York City.—The Cement World.

Faith at Waterloo

NAPOLEON hurled the flower of France against Wellington's solid squares of British steel. The Iron Duke re-formed his broken lines and waited for the next charge. Napoleon was pitiless: Wellington, stolid. The former took a chance: the latter had faith in his men, faith in the allies, and above all faith in Blucher. These are times of trial; for some men these are times when business faith is shaken to its foundations: yet Wellington's squares held until Blucher arrived. Wellington had confidence—and confidence is half the battle. The manufacturer advertising his products in the engineering and contracting world must have faith in the value of advertising. Faith won the battle of Waterloo, and faith will win the war in Europe and business battles in Canada.

It is reported that at the works of the Bethlehem Steel Company, South Bethlehem, Pennsylvania, ten per cent. of the workmen were formerly Germans, but that the number has now been reduced to four per cent. Bomb plots, with the object of interfering with the prduction of war materials for the Allies, are feared. A guard of twenty-five men is constantly on duty, and each department of the factory has been separated from other departments, while the workmen are not allowed to pass from one building to another without a special permit.

Strengthening the Macadam Road to Meet Modern Traffic

(Contributed)

FOR many years the navies of the world have seen a contest between the maker of armour plate and the gun. It began when the Merrimac sailed out before the fleets of the United States and let the cannon balls bounce off its iron-plated sides, whereupon all the naval guns in the world became obsolete. So guns of higher power were created—guns which punctured the armour plate of that day with neatness and dispatch. Thereupon the armour-maker produced heavier and stronger steel; whereupon the gun-maker again produced more powerful guns.

West Webster Street, Chillicothe, Mo., showing condition of road BEFORE Tarvia was used.

A similar contest, as old as man, has been waged between the vehicle and the road. Thanks to the genius of MacAdam there was a long period in recent history when the road easily withstood the vehicle. The smooth, hard macadam road, however, invited the development of the automobile, and still more recently the motor truck, and macadam roads were doomed to swift and general destruction. Now, however, the road is getting the better of it again, thanks to the development of the modern, bituminous binders of which Tarvia is the best known.

Many of the old macadam roads do not require rebuilding, and processes have been developed for applying Tarvia to the old surface in such a way as to preserve them from the ravages of modern traffic. In building new roads or rebuilding the old, Tarvia binders are used, these being so strong that the stones are held in place despite all the efforts of traffic to dislodge them.

It is now ten years since these modern binders were introduced into this country and the experience of many communities runs back over the whole period. In Newton, Massachusetts, for instance, there is a section of Newton Boulevard which was treated with Tarvia nine years ago at a cost of 14c. per square yard. The cost of maintainance of the whole Newton Boulevard, comprising five miles of the most heavily travelled automobile road out of Boston, has been brought down to $1,200 a year. The road is 60 ft. wide.

Cleveland, Ohio, has a stretch on Bellflower Road which was put down in 1905, and which has been in service ten years. Many other towns experimented with Tarvia in the early days, and have now settled down to the use of this material as a fixed policy. Plainfield, N.J., one of these, now has thirty-six miles of well-kept, tarviated road, the result of a consistent and economical policy that was inaugurated in 1908. Another town is Westfield, N.J., with upwards of nineteen miles of smooth roads that have been maintained and made dustless with Tarvia at a very low cost.

Important parks and cemeteries have adopted Tarvia for their roads. The tarviated roads are clean enough and dry enough to use as walks and at the same time the surface will withstand the transportation of heavy monuments. Graceland Cemetery, in Chicago, began to tarviate its roads in 1908, and now it has completed the treatment of its entire system. Government engineers have been using Tarvia largely in the roads about Washington, the White House Driveway having been maintained with this material since 1911.

The use of tarvia-reinforced roads may be said to be in its infancy. The automobile has spread over the continent and the motor truck is fast following. The latter is already a serious problem in England and in some of the most congested centres of the United States. The more efficient the motor truck becomes, the larger loads it will carry, and the greater will be the burden it imposes on the roadway. Motor bus and jitney also bring their problems.

Plain macadam without bituminous treatment must become everywhere a thing of the past as it has already done in many localities. Unfit for modern traffic it must be discarded in favor of roads that are firmly united by some plastic bituminous binder like Tarvia.

In Switzerland a fireproof building material is made by compressing Portland cement and asbestos fibre into blocks.

The same street AFTER Tarvia was used.

The Evolution of Asphalt Pavement Construction in Toronto

By Geo. Powell, Deputy City Engineer

IN the year 1888 the first asphalt pavement was laid in Toronto, on Bay Street, between King and Front Streets. The construction of this pavement created a great deal of interest, as it marked the inception of an entirely new class of pavement in Toronto. Almost any time during the day crowds could be seen on the sidewalks, showing a very deep interest in what was going on, especially when the surface gang, composed mostly of negroes, started to work.

The men employed on the surface work were practically all imported from the States, and it was quite a long time before there were enough local men sufficiently well broken in on the work to make it unnecessary to retain the negro experts longer. To-day there are perhaps two or three colored men still engaged in the work of laying asphalt pavements.

Mr. George Powell, Deputy City Engineer of Toronto.

At the present time the construction of any pavement, be it asphalt or something else, creates only a passing interest, to such an extent have the people become accustomed to modern methods of building good roads.

The specifications governing the construction of this first pavement were somewhat meagre and apparently the five-year guarantee demanded was thought to be sufficient protection. The foundation was composed of 6 ins. of hydraulic cement concrete of the following proportions: 1 part hydraulic cement, 2 parts sand, and sufficient crushed stone or brick to give a surplus of mortar when rammed. A rather indefinite specification, you will admit. However, the work must have been good, for a large portion of the original concrete is still on the street and does not show any signs of failure.

The surface consisted of a cushion coat, ½-in. in thickness, and a surface of 2 ins., or a total depth of wearing surface of 2½ ins. The usual methods of rolling and finishing were used. The cushion coat was of poorer mixture than the surface and served no useful purpose except that it would have probably proved difficult to rake to an even surface a mixture having so great a thickness as 2½ ins.

This type of pavement was used on all streets, whether of light or heavy traffic, until 1892, except that in 1889 the proportions for the concrete were changed and Portland cement was specified. The proportions were as follows: I part Portland cement, 5 parts sand, and enough broken stone (no bricks this time) to give a surplus of mortar when rammed. In 1892 the popularity of the asphalt pavement become very apparent, but the cost, which was upwards of $4.00 per sq. yd., was prohibitive; so a new pavement for light traffic streets as designed, which reduced the cost to about $2.50 per sq. yd.

This light asphalt pavement consisted of a 4-in. concrete base, with a 2-in. asphalt surface. No cushion was used in the construction of this pavement. In 1895 the possibilities of the light asphalt pavement became very apparent, for in that year the light pavement was used on all residential streets. The specification became standardized, and the price had been reduced to about $2.00 per sq. yd. The concrete was composed of 1 part cement, 3 parts sand and 6 parts stone. The surface was 2 ins. in thickness, with no cushion or binder. From 1895 to 1910 the light asphalt pavement was the standard for residential or light traffic streets, the only change occurring in 1901, when the proportions of stone, sand and cement in the concrete were changed to 1:3:7.

During this interval by far the greater part of the yardage of asphalt pavements laid in the city was of the light type; and, generally speaking, it has given the greatest satisfaction. The price of this pavement was at one time as low as $1.30 per sq. yd., caused by an epidemic of price cutting, but a fair average during this time would prabably be $1.75 per sq. yd. The guarantee varied from 5 to 10 years. To-day there are many of these pavements that are out of guarantee and that are giving good service; and the repairs required annually are not so serious as to render it necessary to resurface the streets.

The popularity of this type of pavement, however, led to difficulties, and in several instances this type of construction was used on streets that were of residential character at the time the pavement was laid, but, due to the good pavement and the changed character of the district, a much heavier traffic reached the street than was anticipated, with the result that the pavements failed either on the surface or in the foundation a few years after they were constructed. These mistakes in judgment, together with the advent of the high speed motor truck, led us in 1910 to discontinue the construction of the light pavement altogether.

In 1908 a medium type of pavement was introduced to provide for those strets that were not entirely residential, and on which it was considered that heavy traffic might occur in the future. This was an effort to provide a cheap pavement for all classes of traffic and at the same time to prevent a recurrence of the trouble referred to above in connection with the light pavement.

This pavement consisted of a 5-in. foundation of 1:3:7 mix, 1-in. of binder and 2 ins. of surface. In

1910 this type was substituted for the light pavement and became the standard for all streets except those in the downtown district or those upon which there were street-car lines.

Turning now to the heavy pavements, we find there was little or no change from 1888 to 1900 with the exceptions noted above in regard to changes in the proportions for concrete. In 1900 the cushion coat was abandoned and a binder coat ¾-in. in thickness was substituted, with a surface of 1¾ ins. The binder provided a better mechanical bond between the asphalt surface and the concrete foundation, and it was also supposed to prevent the absorption of moisture from the concrete, causing the pavement to deteriorate from below. In 1903 another change was made in the surface. The total depth of surface was increased to 3 ins., made up of 1-in. of base and 2 ins. of top. From 1903 to 1913 the heavy pavement consisted of 6 ins. of 1:3:7 concrete, 1-in. of binder and 2 ins. of surface. In 1914 the binder course was increased to 1½ ins., the surface remaining at 2 ins., and what is termed a "close" binder was specified instead of the open binder formerly used.

The open binder was composed of ¾-in. stone coated with asphalt, with little or no fines, while the close binder is made of graded stone with sufficient fines added to at least partially fill the voids.

The close binder was adopted for two reasons: first, on account of the difficulty in getting the open binder to stay in place during the process of laying the surface, and second, it was considered that a better surface could be produced by using a binder that was at least partially filled to start with.

Towards the close of 1914 the depth of concrete used on streets with track allowances was increased from 6 ins. to 8 ins., as it was thought that the heavy impact stresses caused by large motor trucks with steel tires were likely to cause failure of the narrow strips of pavement alongside the rails, as it is quite impossible, under present conditions in Toronto, to get any reasonable distribution of traffic on the streets where car tracks are constructed.

Methods of Repairing Brick Pavements After Street Openings[*]

So much of the mechanism of a modern city lies under the surface of its streets that the question of street repair is scarcely less vital than that of good original paving construction, if streets are to be constantly serviceable. The excavator is the worst foe of any pavement, and the efficient repair man is its best friend, and will be so long as sewer, water, gas, telephone, power and steam lines are laid in conduits or trenches.

Foresight will lessen the number of openings that it is necessary to make in a completed pavement, but no pavement is ever laid in a growing town without the certainty that it will be disturbed from time to time. In Cleveland, where we have a preponderating mileage of brick streets, it has been necessary to work out careful methods for the replacement of brick paving that has been disturbed. While the process calls for workmanlike exactness, we pride ourselves on patching brick streets so that their strength is unimpaired, and, in many instances, so that the patch cannot be noticed by a casual observation. This is more than can be said for some other forms of pavement.

Our first precaution is to have the city re-lay all the disturbed pavement. Service corporations and other private concerns are permitted to make openings in streets upon filing proper application. With this application must come a deposit sufficient to cover the cost of replacing the pavement. The city inspects the methods of excavation, and particularly dictates the methods of backfilling. But when it comes to the actual re-paving no one but the employees of my department are entrusted to do the work. The cost is deducted from the deposit, and the balance, if any, is returned to the party making the excavation.

I am a firm believer in the policy of compelling the return of all excavated earth to the trench. Only in case of rock excavation would I make any exception. It may be argued that the pipe or conduit takes up a certain amount of space and that therefore a corresponding volume of earth may be left out of the trench. But experience shows that, by tamping, more earth can always be returned to a trench than was removed from it, and the practice of requiring it all to be returned leaves no pretext for spongy backfills, which are a dangerous menace to the security of any pavement.

In replacing a brick pavement over a trench we adhere closely to the original specifications used in constructing the pavement, levelling the subgrade and laying successively the concrete base, the sand cushion and the brick.

The joint of the completed patch with the original pavement, must be, of course, in the original serrated pattern. In making the cut through the pavement sometimes alternate bricks will be broken in the middle, leaving a series of broken bricks along the edge of the cut. These half bricks must be "toothed" out with a chisel. We use one about 18 ins. long, so that none but whole bricks remain. It is then possible to break joints in patching. A patch which does not dovetail into the original pavement, but leaves a long straight longitudinal joint between patch and pavement, cannot be condemned too strongly.

I may remark that a long-handled chisel is the best instrument to use in making the original cut in a pavement. After an opening has been broken with a maul the chisel can be used to cut and pry out each brick separately, making a cleaner opening and facilitating the patcher's job.

Matching brick for the patch is an important matter. If the color and size coincide with the original pavement, the patch will be scarcely noticeable. The brick should be carefully measured in matching for size. Where the new bricks are a hair's breadth thicker than the old ones the courses are thrown out of series and good joints are impossible.

The proper compacting of the sand cushion presents a difficulty that is not found in new jobs of paving. Probably sand has been lost from the original cushion during excavation, and it is necessary not only to compress the sand cushion downward in marking the repair, but to force it laterally under the edges of the old pavement. For this purpose we use a form of sand rammer, consisting of an iron handle 6 ft. in length, with a rectangular head turned at an angle of 45 degrees from the line of the handle. This compacts the sand at the edge of the cut, and an ordinary wooden rammer or a narrow hand-roller does the same service for the width of the patch.

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[*] By P. J. Masterton, Superintendent of Street Repairs, Cleveland, Ohio, in Good Roads.

Grouting must be done with care and exactness, two to four applications being swept into the joints, and the brick swept clean at the last application. The remaining part of the task is simple precaution against disturbances while the grout is setting. The patch should be covered with three inches of moist sand and barricaded for a period of ten days or two weeks. It is a good extra precaution to barricade the entire street, where conditions permit, and thus avoid the jar of passing vehicles; but this is rarely possible on the ordinary busy street, so the best that we can do is to keep traffic off the patch during the period of setting.

These were the methods used in replacing over 42,000 feet of pavement last year. Our department deals with many kinds of pavements, and while there are others upon which superficial repairs can be made more easily and promptly, there is none in which the original strength of the pavement is restored more fully than in a brick pavement when there is due care in the workmanship and a careful selection of materials.

The Importance of Maintenance in Road Work

By Major W. W. Crosby[*]

THE importance of proper maintenance cannot be over-estimated. In the older European countries its importance is fully appreciated, and the reputation for good roads that some of these countries enjoy rests upon their careful and efficient maintenance work.

It seems strange that in this country the extravagance of the neglect of proper maintenance has not attracted more attention. It is a well-known fact—or it should be—that the neglect of maintenance increases the amount of deterioration out of all proportion to the time involved, and, therefore, correspondingly increases the cost of repair. In other words, if a newly built road without maintenance will require $100 for repairs at the end of the first year, at the end of the second year it will require, not twice that amount, but more than twice that amount; at the end of the third year, not three times $100, but something like $1,000, or even more. At the end of five years, the bill for putting the road back into good condition would be, not $500, but more likely $2,500. If, on the other hand, $100 would have put it in good condition at the end of the first year, and this $100 had been expended properly, then another $100 would have been required at the end of the second year, and at the end of five years $500, not $2,500, would have to be expended.

Major Crosby.

There is no question but that the same system of constant care over the roadbed as is adopted by the railroads is the most economical for highway work. As a general thing, the construction and maintenance work of the railroads of this country has been performed efficiently and economically, and it is reasonable to assume therefore that the constant, careful maintenance of railroad tracks and other properties is considered by the railroads as simply good business and that their judgment in the matter is worth respecting. Why then should exactly the opposite view apparently be taken by highway authorities?

Where highway maintenance has been attempted to some extent two schemes have been adopted quite generally, and probably the bulk of the maintenance in this country has been carried out under one or the other of these. One is the assignment of a more or less definite section of a public road to an individual for maintenance. This man is credited with a limited fund, and in general is left to his own devices for performing the work, for selecting the time of its performance, and for its quality. In the majority of cases the result has been a failure, and the reasons for such a result are the natural ones. In the first place, the man is selected usually on political grounds, and not on the ground of economy and efficiency. In the second place, when a selection is made with the intention of picking the best possible man for the place, the lack of definite agreement as to what work shall be done and how and where it shall be done results in the performance of the work when it best suits the man having it in charge.

In the other scheme of so-called maintenance, a man is selected to take charge of the work in a considerable portion of the area covered by the central authority, and there is placed to his credit a limited but often fairly large sum for carrying on the work. In some cases he receives no salary, or only a nominal one. The statements made concerning the selection of the man under the other scheme apply equally well under this. Even in the event of the selection of the proper man for the work and the payment to him of a proper salary, the conduct of the work in most cases is uneconomical, inefficient and unsatisfactory, because the usual way of performing it is to get together a gang of men and teams and start out, either before the time for farm work in the spring, or after the harvest in the fall, and, taking the roads consecutively, to attempt to do all the work for the year at one time, and that time a short time. For the balance of the year the roads get no attention at all; the repairs are intermittent and irregular, instead of constant, regular and careful.

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A man cannot run his farm and at the same time give proper attention to the maintenance of several miles of highway, because the demands of the two kinds of business are bound to conflict. The one exception to this is in the matter of the log drag; the farmer can do valuable work on the road with this implement, and he can use it to the best advantage when weather conditions are such that a team can well be spared from the farm work.

The reason for the neglect of our roads is that construction has been allowed or encouraged to interfere with, and prevent, proper maintenance. In any new country the construction of roads of some kind or another is one of the first necessities, and in a country as large as this it has been impossible, of course, to build all the roads demanded as fast as they were needed; and it has also been impossible to replace one form of construction by another more suitable to the rapidly increasing traffic when the need for such reconstruction became evident. As a consequence road authorities, with the limited funds at their disposal, have been obliged to devote their energies largely to new construction, and to neglect, to some extent at least, the maintenance of the roads completed earlier. In addition, the difference between unimproved paths which had developed into roads through the amount of traffic over old trails and the improved roads—even though the latter had fallen into a deplorable condition through neglect—was so great that the public demand was for further construction rather than for the restoration of the deteriorated earlier construction. Well stoned roads, even though worn into holes and most unsatisfactory at certain seasons, were so much better, in the opinion of the public, than the unstoned roads that there was a demand for further stoning rather than for the repair of roads already stoned—at least until the latter got to be nearly impassable.

Again, the organization of a locality's forces has usually been at fault in the neglect of maintenance. Those in charge of road work have generally had under their jurisdiction both construction and repair. The requirements of maintenance work demand the prompt and careful performance of little things, persistence and continuity of action, good judgment and craftmanship in actual work, and a high regard for economy. Maintenance work includes far less of the spectacular than does construction. On the other hand, the problems of construction are interesting and relatively short-lived, demanding spurts rather than long-winded action. Among human beings in this country the men of the bulldog, tenacious type in effort are less common than those keenly interested for the time being and capable of short spectacular dashes at high speed. For this reason there has been in the road departments a lack of interest in maintenance work and a tendency to neglect it for the more interesting work of construction.

With the advent of the modern road and the realization of its high first cost there has been an awakening to the desirability of securing as much good as possible from the initial outlay and to the only means of securing the most good—i.e., through the proper maintenance of new construction. The subject of maintenance therefore is beginning to be discussed as much as the subject of construction. As a matter of fact, construction itself is generally subordinate to maintenance. Maintenance needs construction for its being. In other words, a thing cannot be maintained until it has been constructed. What determines the character of the road surface to be constructed? Is it not consideration of the cost of maintaining the best surface possible under traffic? And is not the selection made because one surface will be more easily and cheaply maintained and more satisfactory in service?

The first necessity in the maintenance of any kind of road is to prevent damage by water. An earth road must be kept crowned, so that water falling upon it will not remain on the carriageway, but will be shed to the sides and then disposed of in such a way that it will not be absorbed by the roadway or its foundation. The best and cheapest means yet devised for crowning and keeping the roadway in condition is the continuous proper use of the log drag. This implement will be found useful and economical in the maintenance of any roadway with earthy or gravelly shoulders, even if the road has a centre strip of as hard a material as concrete. The next thing of importance is to see that the water courses along the road and under it are kept open. Obstructions, such as earth, leaves, brush, etc., must be prevented or removed promptly if washouts and other results expensive to correct are to be avoided.

Having taken care of the water, the next thing is to repair and care for the road surface, so that it will remain as impervious as possible to water and as even and homogeneous as practicable under the wear it has to sustain. The log drag is the best means for obtaining these results on an earth or soil road, and it will also be a great help on a sand-clay road. As the road crust grows harder the use of the drag must give way to hand labor with a pick, rake, shovel, and perhaps a tamper. If, for instance, a small depression that holds water appears on a gravel road, it must be repaired promptly if a serious hole is to be avoided. If the bottom of the depression is tight and firm, the material should be picked loose for an inch or so in depth. If, on the contrary, it is loose, clean out the loose material until the edges of the hole are nearly vertical, and then put in fresh material, tamping it well and covering it with finer sizes so as to aid in compaction. For repairs always use, as nearly as possible, the same material as exists in the adjacent roadway.

Broken stone roads, in the main, should be treated in the same way. Sometimes both gravel and broken stone roads show a tendency to ravel in dry seasons. If the effect is due merely to dryness, one of the best remedies is to apply a thin layer of sand (not over ¼ in. thick) before the ravelling has gone too far. The surface will then quickly tighten up under traffic. Do not use clay. If this application of sand is delayed until the ravelling extends an inch or more below the surface and generally over the whole road, it will be necessary to use a roller and water to restore the surface to the proper condition.

All these things are little things, but in order to prevent large expenditures for repairs the little matters of maintenance must be attended to promptly and efficiently.

Construction problems will undoubtedly be presented for solution and discussion, more or less intermittently, for years to come, as changes in traffic occur and as the knowledge of the science of road building develops. Maintenance problems should and will be discussed continuously to an indefinite future. They are affected by traffic conditions, by new solutions of construction problems, and by changes in social conditions. Their importance is increasing, and the general appreciation of their importance is increasing also. For the next few years, at least, this appreciation cannot increase too much or spread too widely, for we are behind in making a start in the matter.

The Design and Construction of Buildings for Industrial Purposes

TO the factory architect are offered many great and absorbing problems, and only in the case of prohibition through cost are we ever supposed to be confronted with the impossible. Somehow or other we are called upon to meet various conditions and develop them upon the lines required for the undertakings we are engaged upon, and if we accomplish this, as a rule the ultimate forms are left to us to deal with without restraint.

The middle of the nineteenth century probably saw the greatest activity in factory undertakings. These buildings throughout the United Kingdom are familiar to us all. All of much the same type of design, somewhat dull and uninteresting, but always of a solid, heavy type, as reflecting the character and solidity of the businesses carried on therein, they stand to this day, still performing useful work. As a rule they are constructed of local material, but in none of them did it appear as though any very great thought had been expended upon the convenience of the employees.

The most marked change between the early factories of the nineteenth century and the present time is not only due to the better housing of the employees, but to an entirely different mode of construction and material employed in the buildings themselves. The older factories were of small spans as regards covered area, with wooden roof principals and floor beams, and with more or less adequate fire-escape arrangements. Timber was the usual and practically the only material to bridge large spans; bricks and mortar the usual wall construction; slung floors were usually of timber; special beams cast iron, columns of the same metal.

I hardly think my subject entitles me to consider the works site, but I should like to say a word on the question of the widths of roadways dividing the factory buildings. In so many factories these are to be found of varying widths from 26 ft. to 40 ft. Such spaces seem to me totally inadequate for present-day requirements, especially where sidings run through these roadways. There are undoubtedly occasions when as much as 200 ft. between factories is not too much. The average works cannot face the loss in acreage that would be the result from a width of 200 ft., but I would like to fix a minimum of 100 ft.; and should this space at first not be wholly occupied by sidings, power mains, etc., the space between the paved roads can be sown with grass until the time arrives when this space is demanded for traffic or other works equipment; and we cannot overestimate the value of these wide roads as fire screens.

Classification

The various buildings comprising the usual factory undertakings may be roughly stated as follows: office and administrative department; raw goods stores; general factory buildings; warehouses for finished goods; power plant buildings, including boiler house, etc.; attendant and by-product buildings.

Our aim in the planning of such a factory must be the arrangement of these various buildings, and the departments comprised in each, in such order as to ensure the passage of the raw materials, entering from one, two, or more sources of supply, through the successive shops until the goods reach their final state, and are stored in the warehouse for distribution to the customer. This passage of the articles under manufacture must, if possible, be arranged without reentering or recrossing departments through which in course of manufacture they have previously passed. Such a process in many cases means a simple arrangement for passing the goods from one side of the building to another or from the top of a many-storied building to the bottom; but in factories where the goods are partly manufactured or handled in the various shops and completed or assembled in others, the scheming to bring each department successively within touch of the other requires care and thought in planning, and for this purpose it is essential for the architect to make himself generally acquainted with the process of manufacture in each case.

The administrative department is a departmental office concerned in the management of the factory itself, and generally includes the following:—Time and wage office, cloak-rooms, bathrooms and latrines, clothes drying-room, rest-room, surgery, manager's and clerks' offices. This block must be placed at a point most convenient to the factory building it serves, and in such a situation as to allow of the rapid distribution of the workpeople to the several departments in the building. Such position may be either the corner, the side, or in the centre, and as far as possible arranged so that the workpeople can reach their own particular work by galleries or passages without traversing the floors of a shop in which they are not engaged. The relative position of the administrative block with the works entrance is not of importance, except that where possible sidings should not have to be crossed by the employees.

In factories made up of a large number of large isolated buildings, or in single factories covering a considerable area of ground, it is desirable to divide and duplicate the administrative department. In plan it should include a large assembly vestibule, out of which opens the wage and time-checking room. This vestibule provides proper accommodation for the workpeople to congregate under cover during the few minutes taken in signing on and on leaving the factory, and also during the time when the wages are being paid. Opening from this vestibule are the cloakrooms, with lockers for each individual employee. In factories where the hands number some hundreds, an attendant's office will be necessary, and this should be placed in full command of the cloak-room and other offices opening from same. The duty of this attendant will be to check the times in and out during the working hours, and be generally responsible for the cleanliness of this department.

The latrine buildings should have the walls of white-glazed bricks, and partitions carried some inches from the ground, and to a height of 6 ft. or 6 ft. 6 ins., plain unmoulded doors, tiled floors laid with proper falls to gulleys, so that the buildings can be thoroughly cleansed with a hose pipe. Opening from the cloakroom should be the bathrooms; these formed usually as shower baths, with simple arrangement for hot and cold water supply, the shower enclosed in a small partition, off which is a small dressing space.

The style of manager's office (and, if necessary, the clerks' office) will depend entirely on the system of departmental management of the particular factory. These rooms where possible should be placed in such a position as to overlook the factory.

There are still two departments required to complete this block, namely, the first aid surgery and the rest-room. For the surgery a small room with tiled walls, tiled floor, having small operating table, couch, medicine chest, antiseptic ointments, bandages, plain splints, with small sink, hot and cold water, electric radiator, and electric kettle.

The other so-named luxury is the rest-room. These rooms are required only where girl labour is employed, and should be as unlike any part of the factory building as possible. They are used by the workers in cases of faintness and sickness, the girls being granted permission on application to the forewoman of their department, and here are permitted to spend an hour in comfortable, quiet, and restful surroundings. The room is under the supervision of a matron attendant.

Materials of Construction

The following are offered to us for choice:—Brick structure wholly, with wood or cement floors, and with wooden or steel roofs; steel and brick composite buildings, with wooden or slung concrete floors, steel or wooden roofs; steel structure; reinforced concrete structure.

Some twenty to thirty years ago the forms of composite buildings varied very considerably, and were designed in both iron and steel in peculiar forms for each undertaking. Gradually out of this somewhat chaotic state the designs became more uniform; joists, girders, and roof principals were catalogued, and almost all forms of major items in the buildings were carried out in a generally recognized design. Girder connections, seatings, and brackets have been further standardized, and perhaps we are now too well supplied by manufacturers and constructional engineers with catalogues of these details, which, whilst forming a constant and convenient reference, are inclined to check research and enterprise in the way of new forms.

There is another and a newer form of construction that is claiming and demanding very serious consideration at our hands, and that is reinforced concrete. The earlier promoters, for reasons best known to themselves, desired to treat the architect as neither knowing nor wishing to know anything of this science of building. That it is a wonderful science is undoubted, and its ready acceptance on the Continent and abroad has enabled many regions of the world to be brought almost into the heart of commercial life. To my mind, bridge construction, riverside piers, jetties, retaining walls, silo buildings, cooling towers, culverts, and the more peculiar forms, are the lines upon which reinforced concrete finds its particular outlet. One hesitates to accept this form of construction for the average factory, on account of the many changes that are constantly being made, especially as regards machinery. These changes invariably lead to the cutting of floors, rearrangement of loads and points of support, and one cannot get away from the feeling that during these changes the cutting of a main member might possibly mean a partial collapse.

Floors and Roofs

The construction and finish of factory floors is a matter requiring care and experience. To-day we have constantly brought to our notice different forms of floor construction—fire-resisting blocks, patent joists, etc.—but I believe most of us prefer to use the ordinary steel joist and concrete filled floor, and, in special cases, girders with concrete filling, boxed out and strengthened with mesh metal. It is unnecessary to state that the weights of the loads to be carried must be most carefully calculated, so that there will be no straining of the structure, and the surfaces of the floors must be properly prepared to take the finishing necessary for the special class of factory we are dealing with at the moment. These finishings may be roughly taken as follows:—Engine and power stations, hard tile; boiler houses, blue brick; chemical factories, blue acid-proof brick, with acid-proof asphalt; factories, granolithic paving, asphalt and wood blocks.

The roof of a factory is perhaps the most interesting detail we have to consider. I do not propose to discuss the different types of roof principals—these have become practically standardized—but I shall refer to one or two peculiar forms that I have often found it necessary to employ. When called upon to erect a factory in a district with which I am not familiar, I generally apply to the nearest observatory for the records of winds and gales, also for particulars of rainfall. Such information is most readily given, and one has then the satisfaction of calculating all details on a sound local basis. In connection with these observatory details, on two occasions after the factories were completed, the observatories were good enough to write stating that gales had just occurred greatly in excess of any previous record; and therefore, in view of the increased spans asked for, it is desirable that no risk should be run when calculating the strains and stresses for this or any other part of the structure. One must admit that at times roofs and girders give the impression of being extremely weighty, and therefore costly, and perhaps it may be only two or three times in the year that they are strained up to their full load.

The roof of the average two or more storied building is usually a single span of the ordinary type of principal suitable to the width, with probably a certain proportion of skylight area, and in some cases peculiar details as regards louvre ventilation. The lighting of large one-storey areas presents more details of interest. The north and east lights are the steadiest for factory buildings, and the usual type of roof is that known as the Weaver roof, in which the northerly side is wholy glazed and the southerly side slated or covered in some other form.

The angle of the north pitch is a matter requiring careful adjustment and is governed by the situation of the works, either at home or abroad. In England and in dull climates, and on the western slope of a valley, the angle with the horizontal must be reduced to about 60 degs. The slated side will be at a pitch of about one-third the span. This angle of 60 degs. may require to be [illegible] in a [illegible] where an unusual amount of ventilation is required. As a rule this ventilation is provided in the form of open louvres framed in the ridge of each roof, and running the whole length from parapet to parapet. These louvres project some 2 ft. to 5 ft. above the ridge. If, then, the pitch of the glazed side is too upright, the outlook from the floor or working level in the shop, and furthest from the skylight, is into this line of louvres, with the result that the shop is unnecessarily darkened. In such a case the pitch of the glazed side of the roof should be reduced, and its exact angle fixed by a trial by diagram. If the shop is one requiring not only ventilation but a very considerable amount of light, the slope of the louvre roofs should also be glazed. The span of these Weaver type roofs varies from 25 ft. to 35 ft. It is worth our while for a moment to consider to what maximum limit of span this type of roof may be taken, so as to be economical as regards construction and satisfactory as regards lighting the shop. Personally, I have no hesitation in taking the span up to 33 ft., but I should call this the extreme limit, and the result in both cases will be quite satisfactory.

So far we have dealt with the span only of this type of roof. The craving amongst manufacturers for large floor spaces with as few supports as possible brings us to the problem of what cross spacing can one economically carry these roofs. Again, 30 ft. to 33 ft. seems to me the economical limit; beyond that special and costly girdering is necessary and is usually arranged as follows: Where the larger spacings bring the points of support parallel with the ridge, the girders are carried above the gutter line and the principals of the roof are framed into the lower plates of these girders; but if the points of support are to be across the line of the ridge, then the girders are formed of a Warren type, with the members following the line of the Weaver roof, in which case both the glazed and slated sides of the roof will be carried through the supporting girders continuously from outside to outside of the factory.

All gutters for this class of roof must be adequate, say 18 ins. to 24 ins. wide, strong cast iron, with rebated joints, and fitted with proper boxed cistern outlets. There is no necessity to have these gutters with tapering cast, as they will clear themselves of water to outlets 50 ft.. to 60 ft. apart, and in case of replacement there is then no likelihood of delay and inconvenience due to the necessity of casting a special taper. If the length between outets is greater than 60 ft. the depth and width of the gutter must necessarily be increased. The gutter outlets are connected to the heads of the columns carrying the roof, which column can be conveniently used as the outlet itself, the column head being arranged so that none of the bolts connecting the roof girders will pass through the head itself, and at the base of the column it will be convenient to cast on sideway outlets, with flanged joints, to connect up to outer bends into the ordinary drain. The core of the column is filled in with concrete to the height of this outlet, and benched off to throw the water outwards. If, as is more usual, stanchions are used as the roof support, downspouts will be carried in the hollow of the stanchions.

For factories of 120 ft. to 150 ft. span, and requiring a considerable amount of light, the following form of roof is being largely adopted on the Continent. The principals spanning the full width are formed as light Warren girders, of a depth between 14 ft. to 20 ft. On both wall sides the whole depth of the girder is glazed, and from the head of the glazing, from one side to the other, concrete flats are formed, but not over the centre one-third of the shop. These flats are laid with a slight fall outwards. The space left in the centre of the roof is then framed as an ordinary pitch roof, glazed on both sides. Such a roof gives an enormous amount of light into the area covered, and if it is used in a shop where ventilation is very necessary, the centre portion of the roof is lifted from the level of the flat on to framed louvres.

I have referred frequently to roof glazing, and in all cases I have had in mind the many excellent forms of patent roof glazing which are turned out by English manufacturers. Most of the patentees have carefully considered and can now with equal facility glaze their bars into timber, steel, or concrete connections, and provide an excellent form of weatherproof glazing even with a pitch as low as one in thirty. Rapidity of execution, easy renewals of broken sheets, and renewals of special parts are not the only advantages. By special arrangement of the bars, one can be certain that condensation will not drop from the roof on to the floor beneath; this is a matter of very considerable importance where the manufacture of certain articles is carried on in shops where a certain amount of free live steam or vapour is given off. Where possible the sheets of glass should not be of greater length than 9 ft., though if required they will be provided up to 11 ft.

Fire Protection

The principles which govern the factory staircase are those which apply to all public buildings, namely, suitability and directness of access. Their position in the works will be governed by a number of considerations, both as regards traffic and purpose, but no circumstances must be allowed to cramp or confine them into out-of-the-way corners. Of a width convenient for the numbers using them—and if this means a greater width along the step than from 7 ft. to 8 ft. the flight must be divided by suitable plain round handrails with strong iron standards, also with plain handrails fixed on the wall side. No flight should be of a greater number than twelve steps, and these not greater than 6 ins. rise or less than 11 ins. on tread. All landings must be full half, and the outlet or doorways at the top or bottom must open into as large a collecting area as possible. In a word, when deciding the position and size of these staircases, one must always have in mind the use of same in case of fire, when quite possibly a mad rush would be made to leave the building. The doors must open out from the staircase; and the flights should be well lighted and ventilated from the sides away from the factory. The materials used for the steps should be either stone or concrete; in some cases slabs of timber, of not less than 3 ins. thick, may be used. Iron fire escape staircases are quite familiar to us all. With these, it is desirable that the risers of each step, so often omitted altogether, should be solid or perforated, to prevent accident to those using the staircases.

One of the most important discussions at the recent annual meeting of The American Concrete Institute Convention was on floors—how to prevent dusting. It appears to be fairly settled that fine material must be absent from the top course. Fairly coarse, hard stone or sand (none of it passing a 30-mesh screen) is recommended, and hard stone has the preference over sand.

Testing Buildings for Settlement During Subway Construction

IN order to ascertain from time to time if there is any movement of buildings, elevated columns or other structures along the route as the result of subway work, permanent benchmarks are established on such structures, writes P. M. Entenmann, of the New York Public Service Commission. A good practice is to set all the marks at some even-numbered elevation so that when checking the elevation of the points it is unnecessary to have the original record in the field, as any other than an even numbered elevation indicates movement. A record of the elevations is kept on 8 x 11-in. sheets which give the plan of the building, a description of the benchmark, etc. Whenever levels are taken on a building a record is made on the sheet and the differences are noted. There is a general sheet for each building. A sheet of similar form is used for elevated-railway columns. In addition to fixing the elevation of some permanent mark on buildings and elevated-railway columns these structures are plumbed so that the movements due to construction can be detected. An auxiliary base-line is run close to the buildings and sights are taken with a transit to points on the top and bottom of the structure. In the case of buildings, marks are cut on the wall as near the roof and as near the sidewalk as possible, and sometimes at intermediate points, and a record made of the reading from these points to the auxiliary base-line. Movement of the building as a whole as well as any change in inclination can then be detected. In the case of elevated-railway columns, marks are cut at top and bottom and readings are taken to the auxiliary base-line, and also to a line at right angles to this line at each column, so that movement in any direction can be observed. These records are kept on 8 x 11-in. sheets similar to the ones for settlement levels. Prior to beginning construction work, an examination is made of each building which might be affected by the work. A report is made of the condition of each room of the building describing all the defects in the walls, ceilings and all ordinary conditions which might later be attributed to subway work, and in addition a similar record is made of the condition of the exterior, the cellar and the roof.

Depositing Concrete in Deep Water Through a Pipe

Writing on "Deep-water Concreting through a Tube," in Concrete and Constructional Engineering, Mr. E. B. Von de Greyn says concrete deposited in deep water through a pipe should be of a mushy consistency in order that it may flow easily after leaving the end of the pipe under the surface of concrete just previously deposited; it will then spread more evenly after leaving the pipe, thus avoiding the formation of hillocks and making it unnecessary to change the position of the tremie in a horizontal direction as frequently as would be the case if drier concrete were used. Also it will not choke the pipe. A little experimenting at the outset will soon indicate how much water should be used in each batch. After the proper amount is determined it should be regulated by a gauge so as not to vary, consideration being given, of course, to appreciable changes in the amount of moisture in the aggregate. Mushy concrete deposited in water shoud have an excess of cement. There is a loss of cement due to the excess water in the concrete finding its way out and carrying a portion of the cement, which is found in the laitance on top. A 1:2:3 mixture is recommended.

Requirement of 12-in. Curtain Walls

Twelve-inch curtain walls in steel skeleton construction are to be made possible by a revision of the New York building code section dealing with masonry construction. This section has been revised in the course of the general code revision, and will shortly be laid before the Board of Aldermen for adoption as an ordinance. One of its important improvements over the old code is a clause permitting the use for the full height of the building of 12-in. curtain walls in steel skeleton structures where the walls are supported at each floor by the steelwork. The present law requires a considerable increase of wall thickness in the lower storeys, in spite of the fact that the wall does not carry itself. The revision also recognizes terra cotta as a permissible facing equivalent to ashlar. Hollow building blocks of terra cotta may be used in the construction of walls in buildings less than 40 ft. high. A provision for rubble-stone walls is added: these must be 4 ins. thicker than brick, stone or concrete walls, and at least 18 ins. thick, but in all events limited to 60 ft. in height.

Novel Use of Electric Fans

Ventilating fans were employed at Cleveland, Ohio, to force a fire extinguishing compound through underground ducts containing burning cables. Exhaust fans were installed at the opposite end of the duct run to remove the highly inflammable gases which were produced by the volatilization of the rubber and paraffin insulation. It was not until after the cables had burned several hours, however, that this novel use of electric fans could be made, as the burning gases issuing from the conduits prevented men entering the manholes. While the underground cables were being replaced emergency service was furnished through temporary aerial conductors.

Samples of radium-bearing ore from British Columbia have recently been examined by the Mines Department of the Dominion of Canada. The quantity of radium contained in the ore has not yet been announced, but the examination is said to have revealed sufficient radium to make the test of special importance. Magnetite is one of the minerals regarding the possible production of which in Canada the Department has been asked to report, since the supply from Europe is cut off. The very best magnetite is known to exist in British Columbia in large deposits, but they are at present too far from transportation routes to make mining and working the ore practicable or profitable.

The New York Central Railway Company has in use twelve pneumatic ballast-tamping machines supplied by the Ingersoll-Rand Company. Each unit consists of a portable petrol-driven air compressor and two tampers, and can deal, on an average, with 140 sleepers in a day of 5½ hours. The cost per hour, with petrol at 20 cents per gallon and gas engine oil at 40 cents per gallon, was found to be:—Petrol, 32.6 cents, oil 1 cent, labour 34 cents, total, 67.6 cents.

The quantity of cement should invariably be regulated by its weight. If the proportions are stated by volume, a definite weight or number of packages of cement must be assumed to the unit volume.

The Englehart, Ont., Water-Works

(Contributed)

ENGLEHART is a thriving town situated about one hundred miles north of North Bay. The country in which it is located has been regarded until quite recently as nothing but a forest, but its development in late years has been noteworthy. Englehart was incorporated in 1908, and today it has a population of over a thousand people, with an assessment of some two hundred thousand dollars, exclusive of T. & N. O. lands.

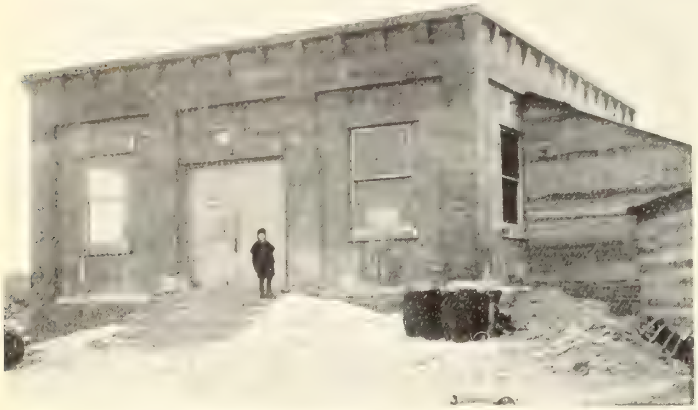


Fig. 1—Pumping station, Englehart water-works.

The Temiskaming & Northern Ontario Railway Company have their divisional headquarters at Englehart, and their shops and roundhouses give the town an additional element of industrial activity. Electrical energy is furnished the town from the water development at Charlton.

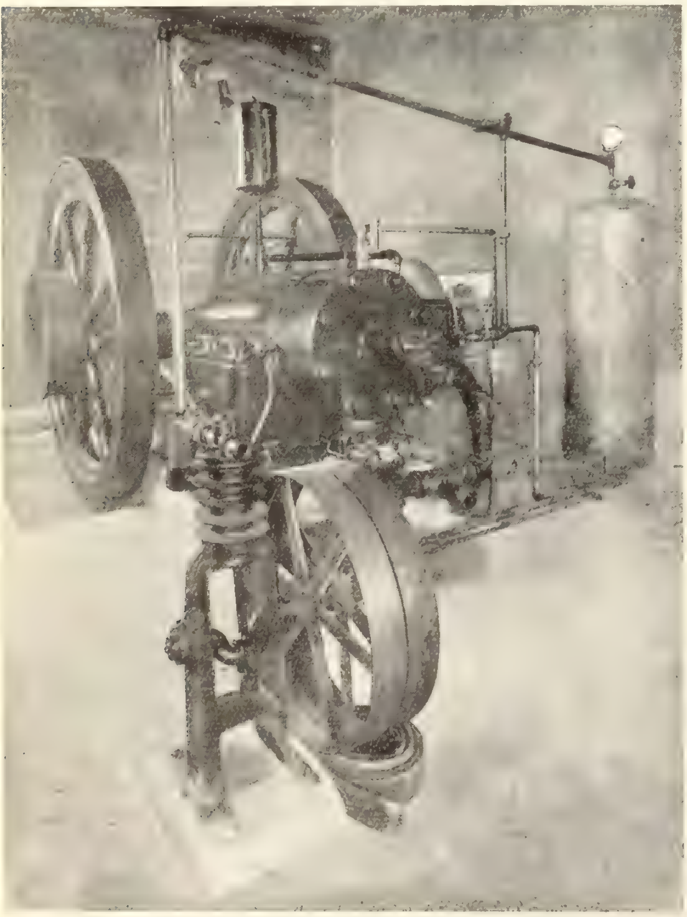


Fig. 2—A 70-h.p. Fairbanks-Morse "Quick Start" oil engine with belted air compressor.

During the last two years the corporation have added their best asset in a modern domestic water-works system with a fire-fighting reserve. The plans for this system were prepared by Messrs. Sutcliffe & Neelands, who also supervised the installation. It must be borne in mind that conditions and temperatures in this northern climate call for protective measures which are quite unnecessary in other parts, and it is noteworthy that the operation of the system has been most satisfactory.

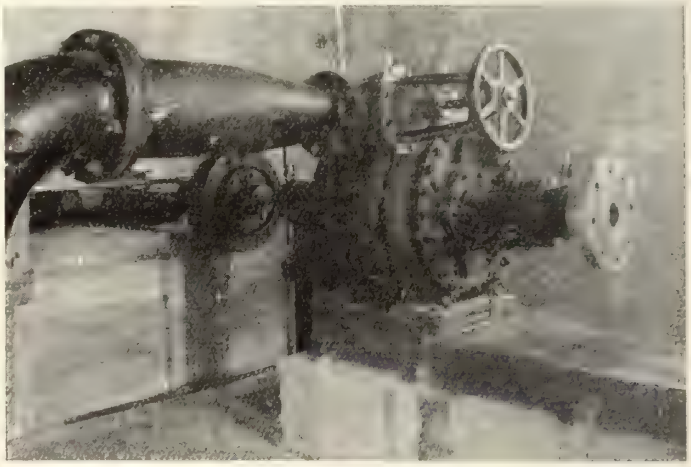


Fig. 3—Two-stage fire pump.

Distribution mains at a depth of eight feet extend through the business and residential section of the town, with provision for coupling on new areas that are rapidly building up. Fire hydrants are located at frequent intervals. The pumping station, illustrated herewith, is built entirely of concrete, and when cleared of construction material will present a very attractive appearance. The pumping machinery was built and installed by The Canadian Fairbanks-Morse Company, Limited, of Toronto. The combination is somewhat original and is worthy of note, since the oil engine, hitherto considered unreliable, is used exclusively for the domestic supply, as well as for the fire-fighting unit. Fig. 2 shows a 70 h.p. Fairbanks-Morse "Quick Start" oil engine of the type "NB" construction. Note the starting apparatus, consisting of a belted air compressor and a vertical air retainer. A pressure of 100 to 120 lbs. is held in reserve for instantaneous starting. As an auxiliary (in the event of an air leak) the engine is fitted with the firm's patent hand starter pump, a combination which insures a "quick start" in the event of a fire. It will be noted that no stand-pipe pressure is available. The outfit burns a low grade distillate and operates on the throttling governor principle. Gear-driven magneto is used for ignition and a gravity oiling system takes care of the lubrication in an improved manner. Power is transmitted to the two-stage fire pump (shown in Fig. 3) through an oil-immersed helical gear box carried on a cement foundation with a metal housing. "Skefko" ball bearings are mounted on each side of the driven gear to reduce friction and prevent end thrust. In Fig. 3 can be seen the friction clutch, which allows of starting the engine under "no-load.". The pump is designed for a capacity of 600 Imperial gallons against 280 ft. head, and runs at a speed of 1165 r.p.m., the engine speed being 210 r.p.m. An extended bedplate with coupling is provided for motor auxiliary

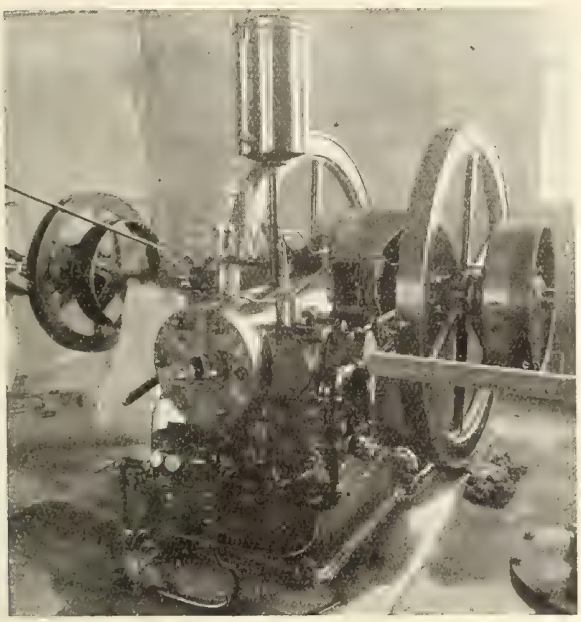


Fig. 4—A 15-h.p. Fairbanks-Morse engine, driving the deep well pump.

connection at a later date. A rising spindle gate valve is provided to relieve the pump from domestic pressure when idle. Fig. 4 shows a 15 h.p. Fairbanks-Morse engine of a design similar to that described above. This unit takes care of the domestic pumping and drives the deep well pump. It operates continuously with splendid economy, day and night. A friction clutch is mounted on the engine shaft for ease in starting. Adjacent to the clutch is a cement pier carrying a ring oiling pillow block for steadying the pump pinion shaft. A 24-in. iron sheave is mounted on a friction clutch, which drives the well head by means of a wire cable. In Fig. 5 there is seen a 7 x 10 in. Goulds Triplex single acting plunger pump, designed for a capacity of 250 Imperial gallons per minute against a pressure of 50 lbs. It will be observed that either the domestic pump or the deep well pump can be operated independently or together. A sliding pinion is provided on the Triplex pump to make this possible. Pressure on the mains is controlled by an excellent device partially shown in the illustration. Directly off the pump discharge is a branch of 2½-in. pipe leading into a Mason Regulator. The discharge from the regulator is piped around to the suction side of the pump, as shown. Back of the check valve in the discharge to the main is an opening which is piped to the pneumatic tank or air chamber, shown in the corner of the building, and from the same outlet a small pipe runs to the diaphragm of the regulator. On the arms shown are placed sufficient weights to counteract the pressure against which it is desired to pump—in this case 50 lbs. When the pressure runs up in the main—due to absence of water-takers—the small pipe leads the pressure over to the diaphragm or plunger of the regulator and forces it open, which allows the pump to run under practically no-load until such time as the main pressure is relieved and the regulator comes back to the closed position. This device is known by the manufacturers as 'Form "L" Control.'

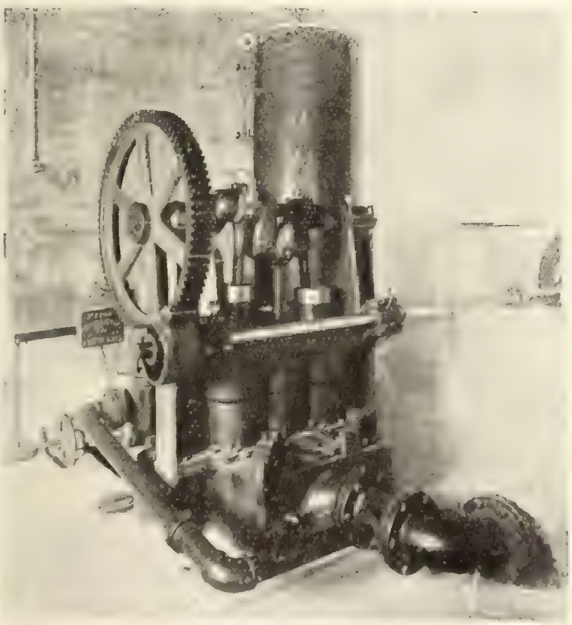


Fig. 5 A 7 in. x 10 in. Gould's triplex single-acting plunger pump.

The deep well unit is situated about 100 ft. from the pump house, and is driven from the pinion shaft by a friction clutch sheave. The transmission cable is ⅝ in. in diameter, and is guided to the head by a universal mule-stand, the well location being at an angle from the drive. The head is a "Goulds" Fig. 1030, using single gear, machine cut. The "A" frames of the head bring the crank-shaft about 6 ft. from the ground level, which permits of a 24-in. stroke. The working barrel used is manufactured by the W. B. Erb Company, of Chicago, and is by far the simplest double acting cylinder we have yet seen in operation.

Water is taken from a depth of about 70 ft. and forced a horizontal distance of possibly 100 feet into an underground reservoir built in the form of an inverted umbrella and roofed with reinforced concrete.

Build Now!

Extremely low bids have been a feature at many lettings this spring. In fact numerous contracts have been taken at prices that seemingly allowed a dangerously small margin between profit and loss. When the successful bidder on a $300,000 job is $75,000 under the engineer's estimate and $50,000 lower than his nearest competitor it is reasonable to conclude that some one has made a mistake in his figures. But when this same thing happens time after time it begins to look as though half the contracting profession was bidding wild. Mistakes, of course, happen frequently, but all the extremely low bids at recent lettings cannot be ascribed to errors in the estimates. It would seem rather that the bidders in their eagerness to secure work are willing to take long chances. Neither has it been the inexperienced contractors that have been submitting the low bids. In fact some of the best known firms in the country have taken jobs at prices that seemed ridiculously low as compared with those of previous years. Of course, many contractors are bidding on work at the present time with the sole purpose of keeping their organizations intact and their outfits busy until jobs more to their liking develop. But there is no good reason why this work should be taken at prices that mean a big loss.—Engineering and Contracting.

The New Building of the Standard Bank at Vancouver

THE new Standard Bank Building at the corner of Hastings and Richards Streets, Vancouver, enjoys the distinction of being one of the city's highest structures, as well as one of the finest modern office blocks on the Pacific coast. It was erected by a company organized by Mr. J. W. Weart, and was designed and constructed under the supervision of Messrs. Russell, Babcock & Rice, architects, of Vancouver. The cost complete ran into $450,000. The general contractors were the Canadian Ferro-Concrete Company, Limited.

The structure is a steel skeleton frame, every portion of which is enclosed in concrete. The floor slabs are of concrete, reinforced with cold twisted bars—a type of construction in which the general contractors specialize. The foundations are carried down to bedrock, and the basement is thoroughly waterproofed.

The Standard Bank Building, Vancouver.

Vancouver now has a by-law which restricts the height of buildings to ten storeys, but the permit for the Standard Bank was taken out before this measure became law; so that the tenants of the five upper storeys have a unique advantage in the way of an unobstructed view on all sides—with no fear of losing it.

For the exterior the architects have employed tiling manufactured by the Kittanning Face Brick Company, of Pittsburg, Pa. The brick is treated by a special process which renders it impervious to water. Atlas Swan White cement and Monterey white sand were used for pointing the brick.

On each of the upper floors of the building there are thirty offices. Ample hall space is provided on each of the floors.

The three lower storeys are terra cotta, with a polished granite base. The next eight storeys are face brick, and the upper storeys are terra cotta.

The interior finish throughout the building is done in eastern white oak. Each office is fitted with porcelain wash-basins, equipped with hot and cold services. The light fixtures are of special design, and each room has extension wall blocks for desk lights. The building is steam-heated, with controlling devices in each suite.

The floor of the outer vestibule is of cedar Tennessee marble, alternating in pattern with Belgian black. Throughout the building the floors are of terrazzo with marble borders. All the lavatories have a marble wainscotting six feet high. The stair treads are of terrazzo, following the general floor surface scheme of the entire structure.

Elaborate precautions have been taken to cope with the fire emergency, escapes and two sets of hose having been provided for each floor. The windows are of metal, fitted with wired glass on the sides exposed to adjoining property. The partition walls are lined with terra cotta. Elevator shafts are enclosed from the corridors with metal frames with wired glass. The floors are of reinforced concrete over steel beams on four-foot centres.

The mechanical equipment includes a steam heating plant with vacuum circulation, a stand-pipe for fire protection, and five electrically-operated traction type elevators with a speed of six hundred feet a minute.

The sand and gravel used in the fireproofing of the building were supplied by the Ritchie Contracting and Supply Company, Limited, who furnished some thirteen thousand cubic yards of material.

The interior decorating and painting was done by Messrs. C. J. Cummings and Company, Vancouver.

Half a part per million of iron in water is detectable by taste, and more than 4 or 5 parts makes water unpalatable, according to water supply paper 273, recently issued by the U. S. Geological Survey. More than 2.5 parts per million in water used for laundering makes a stain on the clothes. Iron must be removed from water from which ice is made, or a cloudy, discolored product will result. An iron content of over 2 or 3 parts per million in water used in the manufacture of paper will stain the paper. Waters having a high iron content have in some places, where they have been used as city supplies, caused an immense amount of trouble and expense, for they favor the growth of Crenothrix to such a degree that the water pipes become clogged with the iron sheaths of that organism.

Large centrifugal pumps, claimed to be the largest of their kind in the world, were recently installed for use in drainage work in New Orleans. Four pumps were ordered and each had to be capable of raising 168,000 gallons of water per minute at 1 ft. head. The delivery opening is 78 in. in diameter. These pumps will have to work at heads varying from 1 ft. to 13 ft., and whereas they will be able to lift 168,000 gallons of water per minute against a 1-ft. head at a speed of 55 revolutions per minute they will have to be run at 113 revolutions per minute in order to raise 90,000 gallons per minute against a 13-ft. head. A fifth and smaller pump was also put down. The latter had an outlet 48 in. in diameter and was designed to deliver 47,500 gallons of water per minute against a head of 3 ft. At the same head the larger pumps deliver 156,000 gallons of water per minute, so that if all five pumps were worked together their combined capacities would be 671,500 gallons per minute, or, say, 966,960,000 gallons per day.

Mainly Constructional

East and West From Coast to Coast

The Paving and Construction Company of Canada is a new firm registered at Montreal.

The Bronze Company, of Preston, Ont., have secured a $200,000 contract for shells, upon which their plant will have to work day and night.

At Toronto, the building employers have signed an agreement with the Bricklayers' Union for a term of twenty months at a rate of fifty-five cents an hour.

Notable among the permits issued recently at Vancouver is one for a large automobile plant at the corner of Hamilton and Davie Streets. The building is to be of mill construction, 75 by 120 feet in dimensions, and five storeys high.

Messrs. Carter-Halls-Aldinger have started work on the new ten-storey store which is to be erected for D. S. Curry opposite the Winnipeg Post Office, at a cost of $225,000. Messrs. J. D. Atchison & Company, of Winnipeg, are the architects.

The City Engineer's office at Calgary has lost three of its best men. Each holds a commission and all are qualified. Lieutenant and Adjutant W. M. Sage was a civil engineer on the staff; Lieutenant W. M. Brooks was also a civil engineer, and Lieutenant F. Lawson was the architect on bridge construction.

Good progress is being made by the Pacific Lock Joint Pipe Company in the work of fabricating and laying the last section of the concrete pipe on the flow line grade of the Sooke Lake water system, which will supply the citizens of Victoria with pure mountain water. The line will be completed early in May.

An interesting engineering undertaking in prospect is an extension to the sewage and water-works system at St. Joseph de Levis, Que. The work is estimated to cost $150,000, but it is not likely that operations will be commenced before next year. Messrs. Gauvin & Beauchemin are engineers to the municipality.

The contract for the erection of a novitiate for the Christian Brothers at Laval des Rapides, P.Q., has been awarded to E. N. and U. Boileau, of Montreal. The plans, drawn up by Viau and Venne, provide for a three-storey building on a site 81 ft. x 200 ft. It will be of stone and concrete construction, the estimated cost being $475,000.

Tenders have been called for the second addition to the No. 1 grain elevator of the Montreal Harbour Commissioners. Plans have been prepared by the John S. Metcalf Company, Limited, Montreal. The piling contract was awarded to the Peter Lyall and Sons Construction Company, Limited, Montreal. The addition, like the rest of the structure, will be of concrete, and has involved the removal to an adjacent site of one of the offices of the Commission.

The falling off in the contracting business is reflected in the balance sheet of the National Brick Company of Laprairie, Limited, for the year ended February 28 last. The earnings were $139,617, a decline of $119,360. Bond interest absorbed $139,146, leaving net earnings of $471, and as one quarterly dividend of $25,000 had been paid, the surplus had to be drawn on to the extent of $24,529. The contraction in building operations after the boom of 1913 meant smaller sales, keener competition and lower prices for brick manufacture. The stocks on hand are valued at $173,244, which is higher than a year ago. During the past year the plant and machinery have been overhauled.

Estey Bros. Company, 2 St. Cecile Street, Montreal, have secured the contract for the ornamental iron and bronze work on the Sun Life Building, Montreal, now being completed. This firm also have the contract for the ornamental iron work on the St. Denis Theatre, Montreal.

Mr. J. A. L. Waddell (of Kansas City), who has designed many well-known bridges in British Columbia, and who has contributed to The Contract Record, has had conferred upon him by the Japanese Government, through its Department of Education, the degree of Hakushi (Doctor of Engineering). This is the fourth doctor's degree conferred on Dr. Waddell, the three other degrees being Doctor of Science, McGill University, 1904; Doctor of Laws, Missouri State University, 1904, and Doctor of Engineering, University of Nebraska, 1911.

Work has started on the five-storey concrete and terra cotta structure which will be erected at the north-west corner of Portage Avenue and Garry Street, at Winnipeg, and which will be finished by November 1st of this year. The ground floor will consist of stores and the four upper floors will be used as offices. The contract has been awarded to the Carter-Halls-Aldinger Company. The new structure will be known as the "Paris Building." The property was bought in 1912 from Sir James Aikins by a Frenchman from Paris. The site is 88 x 130 feet.

The programme of public works for Calgary, as mapped out by Commissioner Garden and City Engineer Craig, totals $465,500. Including the Nose Creek sewer and the Mission bridge work, for which provision has been made, the total will be about $500,000. The programme of work is as follows: boulevard improvements, $10,500; curb and gutter, $15,000; retaining walls, $10,000; sidewalks, $55,000; sanitary sewers, $10,000; storm sewers, $35,000; paving, $100,000; grading, $60,000; trunk sewers (other than Nose Creek), $30,000; Centre Street bridge (required for 1915), $125,000; water main extensions, $15,000; total, $465,500.

Mr. J. D. McArthur, the well-known Winnipeg contractor, passed through Vancouver recently on his way to California, where he will stay some time, visiting the exhibitions at San Francisco and San Diego. Interviewed in Vancouver as to constructional activities and prospects, Mr. McArthur said, in part:—"The acreage for crops in Western Canada will be far greater than ever this year, and the prospects are most hopeful for a record harvest. The western cities will benefit from the harvest, and the general situation, which is already reviving, will take a great change from the improved conditions prevalent. The increased demand for lumber will benefit British Columbia, and thereby this province will be in a better financial condition. We look for an improvement in the method of raising capital for large enterprises like railway construction with the end of the war, for in financing construction the New York market is not as convenient as London, because in the Old Country the issues are for longer terms than in New York, and the percentage demanded for loans is higher in New York. So far as I am concerned personally, I am busier this year than ever before, with the Hudson Bay Railway contract for the Dominion Government, and the construction of the Edmonton, Dunvegan & British Columbia line. The latter is a personal enterprise."

From New Glasgow, N.S., we learn that the Eastern Car Company has been given an order by the Russian Government for two thousand steel frame box cars, and that the Nova Scotia Steel Company has received an order for shells worth $3,500,000. Work will begin at once on both orders. The cars will be shipped in sections from Pictou Landing to Vladivostock.

At Toronto, the construction of the Bloor Street Viaduct is in full-swing, with two hundred and twenty-five men employed. Abutment A has been completed, B and C are well advanced, and work on F has started. Messrs. Quinlan & Robertson, the contractors on the Don Valley section, are pushing the cement work so as to get it completed during the summer. This will allow the steel work to be carried on through the winter, and prevent delay. The time allowed for the contract is three years, but it is hoped to get it done somewhat under that time. The Dominion Bridge Company on the Bloor Street section are also pushing the work to the limit.

Personal Mention

Mr. R. C. Harris, City Works Commissioner of Toronto, is taking a month's holiday with Mrs. Harris at Atlantic City.

Mr. R. H. Thomson, formerly City Engineer of Seattle, has been awarded $15,000 against the Seattle Times in a libel suit for $75,000.

Mr. W. R. Devenish has been appointed Principal Assistant Engineer of the Canadian Government Railways, with office at Moncton, N.B.

Mr. G. W. Northwood, a Winnipeg architect, who went to the front as a captain in the 90th Regiment, has not been heard of since the battle of Langemarck.

Mr. D. B. McIntyre, Superintendent of Construction and Maintenance of the Montreal Electrical Commission, has resigned. He has accepted a position in New York.

Mr. S. Beresford, Winnipeg, representative of the Canada Cement Company, has returned to the western metropolis after a visit to Montreal and other eastern points.

Lieut. Henry Lloyd Owen, a native of Pwllhli, Wales, reported missing in a recent casualty list, is a Moose Jaw architect who has done considerable work in Saskatchewan.

Mr. Leon Archibald, a civil engineer of Regina, formerly in the employ of Messrs. Reilly, Dawson, Hancock & Reilly, of that city, is among those reported wounded in a recent casualty list.

Mr. V. W. Horwood, Provincial Architect of Manitoba, underwent an operation at Rochester, Minn., recently, and is reported to be progressing fairly well, although a second operation will be necessary.

Mr. R. H. Thomson is to bring the work in Strathcona Park on Vancouver Island to a close this summer pending the end of the European war. After July 1st, it is stated, he will open an office as consulting engineer in Seattle.

Mr. W. A. McLean, Chief Engineer of Highways for the Province of Ontario, has been asked to preside over one of the sessions of the Pan-American Road Congress at the Panama Pacific International Exposition at San Francisco next fall.

Mr. A. P. Linton, of the Saskatchewan Highways Commission, read a paper descriptive of the new traffic bridge at Saskatoon before a recent meeting of the Regina Engineering Society. The structure was described briefly in our issue of February 10th last.

The Montreal Board of Control have extended the leave of absence of Major G. Janin, the chief engineer, and Mr. M. Basset, assistant engineer in the public works department, who have gone to the front. Word has been received that Major Janin and his corps of engineers have arrived in England, having sailed on April 19 from Halifax. Major Janin and Mr. Basset now have leave of absence until September 1, the salary of the former being placed at $3,000 per annum, instead of $9,000. It is understood that the Montreal city engineering department is to be reorganized at a little later date.

Mr. James A. Farrell, President of the United States Steel Corporation, passed through Winnipeg recently on his way to Banff, Vancouver and San Francisco. Interviewed in Winnipeg, Mr. Farrell expressed the view that the United States was emerging from a long period of depression, and that the country was on the eve of a new era of constructional and general activity. Mr. Farrell is an interesting personality. He is fifty-two years of age, and commenced work in a steel wire mill in New Haven at the age of sixteen. Until 1888 he was a laborer in the mills of the Pittsburg Wire Company. He worked himself up through various stages until he became General Superintendent of the Oliver Steel and Wire Company. He was made President of the United States Steel Corporation in 1911.

Trade Inquiries

The Weekly Report of the Department of Trade and Commerce contains the following inquiries relating to Canadian trade. The names and addresses of the firms making these inquiries can be obtained by those specially interested in the respective commodities upon application to the Inquiries Branch, Department of Trade and Commerce, Ottawa:

604. **Pails and buckets, barb wire, wire nails, cement, explosives, etc.**—A Glasgow exporting house with extensive trade abroad desires to make arrangements with Canadian manufacturers for purchasing the following: Enamelled pails with covers; galvanized buckets; galvanized barb wire; wire nails; cement; explosives; spades, steel tools, and safes.

605. **Pig iron.**—A Birmingham firm is in the market for mine pig iron, hematite pig iron or charcoal pig iron.

606. **Steel.**—A firm in Birmingham is open to purchase steel, sizes: ¼ inch to 3 inches round, ¼ to 3 inches square, and 1 inch by ¼ inch flat, up to 8 inches by ⅝ inch.

607. **Iron and steel.**—An English firm is open to represent a first-class manufacturer of iron and steel.

608. **Steel billets.**—A Birmingham firm that has hitherto purchased steel billets from the continent of Europe is open to consider quotations.

609. **Steel plates.**—A Norwich firm is in the market for mild steel plates up to 6 feet long and from 12 inches to 36 inches wide, from ½ inch thick down to 26 gauge. Also flat-iron bars of all sizes and thicknesses.

610. **Wire nails.**—A Nottingham firm inquires for quotations.

611. **Spikes, bolts and nuts.**—A South African agent is prepared to take up agency for South Africa in railway dog-spikes, also cart and carriage bolts and nuts. Immediate correspondence is requested.

620. **Lumber, iron and steel.**—A Paris broker invites correspondence from exporters of spruce, pine, oak and fir; also from manufacturers of cast-iron and steel and structural steel.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherst, N.S.
The Town Council have decided to lay a permanent pavement on Upper Victoria, Lawrence and Lower Victoria Streets. Clerk, W. F. Donkin.

Belleville, Ont.
The City Council contemplate paving Forin Street in the near future. Clerk, J. W. Holmes.

Bridgeton, N.S.
Tenders on the construction of a complete system of town sewers will be received until noon, May 29th, by Harry Ruggles, Town Clerk. Plans and specifications at office of Town Clerk.

Cornwall Township, Ont.
Tenders on the completion of the Shaver Creek drain will be received until June 7th by John Mullin, Mille Roches, Township Clerk. Engineers, Magwood & Stidwell, Cornwall.

Finch Township, Ont.
The Township Council have received tenders on the construction of the Butternut Creek drain. Approximate cost, $5,000. Engineers, Magwood & Stidwell, Cornwall.

Niagara Falls, Ont.
The installation of a mechanical filtration plant at Niagara Camp is contemplated by the Department of Militia & Defence, Ottawa. Secretary, E. F. Jarvis, Ottawa. Estimated cost, $6,000.

Peterboro, Ont.
Tenders will be received until May 31st by S. R. Armstrong, Secretary to the Public Utilities Commission, for the installation of a complete steam pumping plant. City Engineer, R. H. Parsons.

The City Council will call for tenders shortly on the construction of concrete, asphaltic concrete and bitulithic paving on Water, George, McDonnell, Park and Hunter Streets. Clerk, S. R. Armstrong.

Port Colborne, Ont.
Tenders will be received until May 20th by D. Alair, Town Clerk, for the construction of about 1,500 feet of concrete sidewalk on Kent Street.

Port Hope, Ont.
The City Council have started work by day labor on the construction of sidewalks on various streets. Clerk, J. W. Sanders.

Renfrew, Ont.
The Town Council have been petitioned to lay macadam paving on various streets, at an estimated cost of $11.-000. Clerk, J. A. Devenny.

Saanich, B.C.
Road improvement debentures to the amount of $450,000 are being offered for sale by the Municipality. Clerk, H. S. Cowper, Municipal Hall, Royal Oak.

St. Joseph de Levis, Que.
The Municipality contemplate extensions to the sewerage and waterworks systems, at an approximate cost of $150,-000. Secretary-Treasurer, H. Bourassa.

St. Vital, Man.
The Municipality have received tenders for the construction of concrete pavement on various streets. Approximate amount, 25,000 square yards. Secretary-Treasurer, J. Desourdis, Grand Vital.

Stratford, Ont.
A sewer will be constructed on Church Street by the City Council. Clerk, R. R. Lang.

Thorold, Ont.
The Town Council contemplate the installation of a sewage system at an estimated cost of about $25,000. Clerk, J. S. Clark.

Toronto, Ont.
The Board of Control will receive tenders until May 25th for one 5,000,000-gallon pump driven by a three phase induction motor, for Riverdale Pumping Station. Plans at office of the Works Department, City Hall.

Tenders on piles and pile driving at the Don Roadway incinerator plant will be received until May 25th by the Board of Control. Specifications at office of Street Commissioner Wilson, City Hall.

Tenders will be received until May 25th by the Board of Control for laying asphalt paving on St. Nicholas and Wellington Streets, and for the construction of concrete curbs on Wellington Street. Commissioner of Works, R. C. Harris.

Transcona, Man.
The Town Council have received tenders on the construction of a concrete sewage reservoir. Estimated cost, $6.-000. Secretary-Treasurer, J. P. Campbell.

Welland, Ont.
The Town Clerk, C. M. Borter, will receive tenders until 4 p.m., May 20th, for the construction of concrete sidewalks during the year. Plans and specifications at office of Engineer, D. T. Black.

CONTRACTS AWARDED

Amherstburg, Ont.
The Town Council have let the contract for paving on Richmond Street to W. G. H. Pettypiece at $7,974.

Eastview, Ont.
The contract for the construction of a concrete sidewalk on Ogilvy Street has been let by the Town Council to M. Desjardines, Eastview.

Esquimalt, B.C.
The contract for the installation of a sewage system in the Craigflower District has been let by the Municipal Council to T. E. Young, 207 Hastings Street, Vancouver. Estimated cost, $25,000.

Toronto, Ont.
The Board of Control have let the following contracts:—asphalt paving on Christie Street to Works Commissioner Harris at $6,334; brick block paving on Christie Street to Grant Contracting Company, 50 Front Street E., at $7,580; concrete curbing on Regal Road to Ramsay Contracting Company, 39 Indian Road Crescent.

The contract for the installation of a sludge pump has been awarded by the Board of Control to J. Inglis Company, Strachan Avenue, at $6,490.

Windsor, Ont.
The City Council have let contracts for the construction of tile and brick sewers on Victoria and Pelissier Streets to Reid & Murphy, at $3,200, and to Chick Contracting Company, at $2,800.

Railroads, Bridges and Wharves

Brantford Township, Ont.
The Township Council and Provincial Government are discussing the advisability of constructing a river dyke in the Parkdale District. Township Clerk, J. A. Smith, Brantford.

Cap Chat, Que.
The Dominion Government Department of Public Works, Ottawa, will call for tenders shortly on an extension to the breakwater here. Secretary, R. C. Desrochers.

Haldimand County, Ont.
Tenders for the construction of ten or more reinforced concrete highway bridges will be received until June 14th by Chairman Bain of the Good Roads Committee, R. R. No. 1, South Cayuga. Plans and specifications at office of R. G. Kyd, County Engineer, Dunnville, after June 1st.

Petite Riviere, Que.
The construction of an extension to the turning pier is contemplated by the Department of Public Works, Ottawa. Secretary, R. C. Desrochers.

Swan River, Man.
Tenders will be received until May 26th by J. Armstrong, Box 153, Swan River, for the construction of Clark Bridge over Roaring River and Corbett Bridge over Swan River. Plans and specifications at office of Highway Commissioner, Department of Public Works, Parliament Buildings, Winnipeg, Man.

Toronto, Ont.
Tenders will be received until May 25th by the Board of Control for the supply of cedar ties for the Lansdowne Avenue extension to the Civic Railway. Specifications at the Works Department, City Hall.

Woburn, Ont.
Plans drawn by F. Barber, Township Engineer, 57 Adelaide Street E., Toronto, for a concrete bridge over Rouge

River here have been approved by Scarboro Township Council. Approximate cost, $22,000.

CONTRACTS AWARDED

East Williams Township, Ont.
The general contract for the construction of MacLean and Chelew Bridges has been let by the Township Council to W. Witherspoon, Ailsa Craig.

St. Malachie, Que.
The contract for the steel superstructure and wood flooring for a bridge being built here has been let by the Municipality to McKinnon, Holmes & Company, Sherbrooke, Que. Approximate cost of bridge, $10,000.

Toronto, Ont.
The Board of Control have let the contract for the supply of 1,000 gallons of red lead paint for Bloor Street Viaduct to James Langmuir & Company, Limited, Oakville, Ont., at $2.10 per gallon.

Public Buildings, Churches and Schools

Brantford Township, Ont.
Tenders on the construction of a school for School Section No. 6, will be received until May 21st by Taylor & Bodley, Architects, Hope Chambers, Brantford.

Charlottetown, P.E.I.
Tenders for an addition to the Central Christian Church are being received by Chappelle & Hunter, DesBrisay Block. Sandstone and brick construction. Estimated cost, $4,500.

Cochrane, Ont.
The Town Council contemplate the erection of a combined town hall and jail building, estimated to cost $4,000. Clerk, H. J. Brown.

Colborne, Ont.
Tenders will be called shortly for the construction of a fire hall and lock-up for the Town Council. Concrete construction, composition roof. Clerk, H. S. Keyes.

Comber, Ont.
Bulk or separate tenders on the erection of a church here for St. Andrew's Presbyterian Congregation will be received until 1 p.m., May 22nd, by Adams & Adams, Architects, Box 72, Chatham

Edwards, Ont.
Plans of a school estimated to cost $3,500 have been prepared for the School Board by W. Herbert George, Castle Building, Queen Street, Ottawa. Brick construction, concrete foundation, felt and gravel roofing.

Fort William, Ont.
The Board of Education are about to make an addition of one room to the school here and to construct fire escapes. Work will be superintended by Seaman & Penniman, Graham & Horne Block, Approximate cost, $3,000.

Hull, Que.
The Roman Catholic School Commissioners contemplate alterations and improvements to the schools on Riboul and St. Anne Streets, and the installation of modern equipment. Estimated cost, $10,000. Chairman, J. Charon.

New Liskeard, Ont.
The erection of a church is contemplated by the Roman Catholic Congregation. Building Committee, J. W. Bolger, J. Delisle, J. Gibbons, H. O'Grady and A. Soucie.

Parry Island, Ont.
Tenders on the construction of Ryerson School will be received until noon, June 8th, by Duncan C. Scott, Department of Indian Affairs, Ottawa. Plans and specifications at the Post Offices, Collingwood and Owen Sound, at office of A. Logan, Indian Superintendent, Parry Sound, and at Department, Ottawa.

South Woodslee, Ont.
Tenders will be received until May 27th by J. C. Pennington, Architect, Labelle Building, Windsor, for the construction of a town hall, estimated to cost about $3,000. Brick construction, concrete foundation, slate roofing.

St. Octave, Que.
The School Commissioners have decided to build the school by day labor. Secretary-Treasurer, J. V. Martin, St. Octave.

Toronto, Ont.
W. Smith, Architect, 580 Jane Street, has been commissioned by School Section No. 32, York, to prepare plans for a six-roomed school. Brick construction. Approximate cost, $22,000.

Plans for the Jesse Ketchum School have been prepared and tenders will be called shortly. Secretary-Treasurer to Board of Education, W. C. Wilkinson, City Hall. Approximate cost, $185,000.

Waterloo, Ont.
Plans of a heating system for the Central School are being prepared by H. P. Elliott, Sandringham Apartments, London.

Whitby, Ont.
Brown & Fryer, Architects, 204 Clyde Block, Hamilton, will receive tenders until June 11th for the erection of a two-roomed school, estimated to cost $6,000, and for repairs to the High School, estimated to cost $8,000. Plans and specifications at offices of the Architects and of R. N. Bassett, Whitby.

CONTRACTS AWARDED

Alliston, Ont.
The contract for the seating in connection with Knox Presbyterian Church being erected here has been let to Valley Seating Company, Dundas, Ont. Carpentry will be done by day labor.

Aurora, Ont.
The Department of Public Works, Ottawa, have let the contract for interior fittings for the Post Office here to Canadian Office & School Fixture Company, King Street, Preston, Ont.

Clinton, Ont.
The contract for cement and stone work in connection with extensions to the library has been let by the Stavely Library Trust to A. Cantleton, and for brick work to R. Sweet. Material will be purchased by the Trust.

Hanover, Ont.
The contract for interior fittings for the local Post Office has been let to Canadian Office & School Fixture Company, King Street, Preston, Ont.

Milton, Ont.
The Walker Bin & Fixture Company, Limited, 152 Shanley Avenue, Berlin, Ont., have been awarded the contract for the installation of interior fittings in the Post Office here.

Montreal, Que.
The Provincial Department of Public Works, Quebec, have let a contract for repairs to the Court House to J. B. Gratton, Limited, 82 Mercier Avenue. Contract for trimming will be let later. Approximate cost of work, $64,000.

The general contract for alterations to the Carslake Hotel has been let by the Department of Public Works, Ottawa, to R. E. Edwards & Son, 212 Versailles Street.

Richmond Corner, N.B.
Tenders have been received for repairs to the Presbyterian Church here. Chairman of Building Committee, J. H. Hay.

Smith's Falls, Ont.
The Dominion Government Department of Public Works, Ottawa, have let the contract for the installation of interior fittings to the local Post Office to Berlin Interior Hardwood Company, Limited, 72 Wilmot Street, Berlin.

South Gosfield Township, Ont.
Tenders for an addition to the school in Section No. 9 will be received until May 22nd by J. Hickmott, Kingsville P. O. Architect, W. H. Hellems, Kingsville. Approximate cost, $3,000.

Spruce Grove, Alta.
The Trustees of School District No. 450 have been authorized to borrow $3,500 for the erection and equipment of a school.

St. Anselme, N.B.
The School Board have awarded the contract for the erection of a school to M. E. Leblance, St. Anselme. Contractor will require brick. Estimated cost, $13,000.

Stamford Township, Ont.
The masonry contract in connection with the erection of a public school in Section No. 5, has been let to E. Burgar, Chippewa, Ont., and the contract for heating and plumbing to Whistler & Hull, Main Street, Niagara Falls. Interior fittings will be purchased by Trustees.

Teeswater, Ont.
The Town Council have let the general contract for alterations and additions to the Town Hall to Campbell & Donaldson, Teeswater. Frame and brick construction. Approximate cost, $4,000.

Tilbury, Ont.
The Town Council have let the general contract for the erection of a fire hall to John McGee, 11 Paterson Avenue. Approximate cost, $5,000.

Tilbury Township, Ont.
The contract for alterations to the school in Section No. 2 has been awarded to George Cameron, Valette, Ont. Estimated cost, $3,500.

Toronto, Ont.
The following contracts have been let in connection with the Polish Catholic Church to be erected on Gillespie Street: masonry, M. Manley, 1058 College St.; carpentry, J. Simon, 239 Victoria Street; steel work, Dominion Bridge Company, Victoria Street. Roofing, plastering,

heating, painting, plumbing and electrical contracts not let.

The general contract for the erection of a hall on Malvern Avenue for St. John Roman Catholic Church has been let to G. Fensom, 85 Gledhill Avenue. Brick construction. Estimated cost, $6,000.

The general contract for the erection of a mission house for the Sisters of St. John, 28 Major Street, has been let to S. R. Hughes, 81 Portland Street. Brick construction, shingle roof. Estimated cost, $7,500.

Business Buildings and Industrial Plants

Ayer's Cliff, Que.
The erection or purchase of a store to replace that recently destroyed by fire is being considered by A. G. Gough.

Brighton, Ont.
Plans are being prepared for an addition to the foundry of the D. J. Barber Foundry Company, Limited. Director, L. D. Ross, Brighton.

Cranbrook, B.C.
Tenders on the construction of barns, etc., for the Kootenay Industrial School, Cranbrook, will be received until noon, June 17th, by Duncan C. Scott, Department of Indian Affairs, Ottawa. Plans and specifications at Post Offices, Cranbrook, Fernie and Nelson, at office of the Indian Agent, Steele, B.C., and at Industrial School, Cranbrook.

Goderich, Ont.
The North American Chemical Company contemplate an addition to their factory on Maitland Road. Plans not yet prepared.

Howard Township, Ont.
Frank Hiller, Concession 3, Ridgetown, contemplates rebuilding his barns, which were recently destroyed by fire.

Killaloe Station, Ont.
The harness store of J. Stack will be rebuilt.

Montreal, Que.
Work has been started on the erection of a store and flats on Sanguinet Street by David Crevier, 2524 Chateaubriand Street. Estimated cost, $3,500.

Petrolia, Ont.
The erection of a flax mill is contemplated by F. A. Gordon, Board of Trade, Sarnia, Ont. Owner will purchase material, machine power gas plant, steel, etc. Approximate cost, $6,000.

St. John, N.B.
J. W. Clayton is about to erect a store and tenement house at Brussels and Waterloo Streets by day labor, under the supervision of Stanley Williams, Prince William Street. Frame construction, concrete foundation, felt and gravel roofing. Approximate cost, $7,000.

St. Thomas, Ont.
R. H. & J. Dowler, 289 Talbot Street, contemplate rebuilding their store recently destroyed by fire.

Toronto, Ont.
Tenders will be received until May 20th by H. S. Kaplan, 75 McDonnell Avenue, for the erection of an addition to the store and apartments at College Street and Euclid Avenue, for Louis Steinburg, 537 College Street. Brick construction.

Windsor, Ont.
Tenders will be received until May 22nd, by J. C. Pennington, Architect, Labelle Building, for the erection of stores on Ouellette Avenue for Soper & Dupis, 59 Ouellette Avenue. Concrete block and brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $5,000.

Plans of a store and flat to be built on Wyandotte Street for A. Birch, Assumption Street, are being prepared by J. C. Pennington, Labelle Building. Brick construction, concrete foundation, composition paper roofing. Approximate cost, $7,500.

Woodstock, Ont.
The erection of a grand stand on the Fair Grounds is contemplated by the City Council. Clerk, J. Morrison.

CONTRACTS AWARDED

Denfield, Ont.
The general contract for the erection of a cement silo has been let by M. W. Kerr, Morrow Farm, to Rodgers Bros.

Fairbank, Ont.
The contract for the erection of four stores and residences on Dufferin Street has been let by Mrs. Farr to D. A. Lowe, 88 Ennerdale Avenue. Smaller trades sub-let. Brick veneer construction.

The masonry contract in connection with the store and residence being built by O. M. Hodson, 496 Vaughan Road, has been let to G. Huckle, Fourth Avenue. Carpentry, plumbing, heating and painting will be done by day labor. Estimated cost, $3,000.

Gananoque, Ont.
W. J. Gibson, Mill Street, has let the masonry contract for the erection of a barn and garage on King Street to R. Wilson. Balance of work to be done by day labor.

Hamilton, Ont.
In connection with the additions to a bank at King and Hughson Streets for the Dominion Realty Company, 34 King Street West, Toronto, the contract for steel has been let to Hamilton Bridge Works, Bay Street N., Hamilton. All other work will be done by owners. Approximate cost, $4,000.

Hebron, N.S.
The contract for the erection of a store for K. E. Crosby has been let to G. Blewsley, South Ohio, N.S. Estimated cost, $3,000.

Montreal, Que.
The contract for ornamental iron work in connection with the erection of an hotel on Mansfield Street for O. Dufresne, 45 St. Elizabeth Street, has been awarded to Canadian Architectural Iron Works, Bellechasse, Que., and for heating and plumbing to Paquette & Fortin, 79 Cathedral Street.

The general contract for alterations and additions to stables for W. Jacobs, 29 Hermine Street, has been let to Reid, McGregor & Reid, 511 St. Catherine St. West. Approximate cost, $5,000.

New Westminster, B.C.
The contract for piling in connection with the elevator and warehouse to be erected on Front Street for Brackman-Ker Milling Company, has been let to W. Greenlees, 407 Cordova Street, Vancouver. Tenders may be called shortly for superstructure. Approximate cost of work, $50,000.

Quebec, Que.
The contract for roofing in connection with the theatre being erected on Palace Hill for the Victoria Theatre Company has been let to J. A. Bernard, 21 St. Peter Street, and for electrical work to Jobin & Paquet, 72 Cote d'Abraham St.

Sherbrook, Sask.
The general contract for the erection of a store and residence for W. Trenholme has been let to A. W. Haynes, 564 East Seventh Street, Prince Albert.

Springhill, N.S.
The Knights of Pythias have let a contract for the erection of a store and hall to Springhill Manufacturing Company, Springhill. Estimated cost, $8,000.

The Canadian Bank of Commerce have awarded the general contract for the erection of a branch bank here to the Springhill Manufacturing Company, Springhill. Brick construction, concrete foundation. Estimated cost, $11,000.

St. Augustin, Que.
Eugene Germain has let the general contract for the construction of a store and residence to J. Leclerc, St. Augustin. Estimated cost, $4,000.

Toronto, Ont.
The following contracts have been let in connection with alterations to a store on Rose Avenue for M. J. Martin, care of J. M. Cowan, 65 Adelaide Street E.:—masonry, Arthur Bell, 5 Fern Avenue; carpentry, J. Simon, 239 Victoria Street; heating and plumbing, G. A. Winpenny, care of J. M. Cowan; plastering, E. J. Curry, Goodyear Building; roofing, Reggin & Spruce, 530 Front Street W.; wiring, W. E. Sheppard, 345 Grace Street. Painting not yet let.

In connection with the store and residence being built at 380 Queen Street W., for W. Bradshaw & Son, Limited, Wellington Street West, the plumbing and heating contract has been let to S. H. Adamson, 43 Galley Avenue, and the contract for sheet metal roofing to G. D. Mathewson, 734 Queen Street West.

D. C. Murray, 1441 Yonge Street, has let the masonry contract in connection with the erection of a store and residence at 1437 Yonge Street to Brown & Love, 46 Price Street. Tenders have been received for all other trades. Estimated cost, $4,000.

Welland, Ont.
The general contract for the erection of two stores on Main Street E., for Dominic Bruno has been let to W. J. Hickey, 93 Main Street E. Brick construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

Residences

Belleville, Ont.
Arthur Gale, West Bridge Street, contemplates the erection of two residences on Murney's Hill. Plans will be completed shortly.

Blenheim, Ont.
The erection of a frame and brick residence at an estimated cost of $3,000 is contemplated by John Stevens.

Bridgeburg. Ont.
The erection of a residence on Highland Avenue is being considered by B. J. McCormick. Estimated cost, $3,300.

Caledonia, Ont.
The erection of a residence is contemplated by F. Martindale.

Denfield, Ont.
E. Henry is preparing plans for a frame and brick residence estimated to cost $3,000.

Fairbank, Ont.
Charles Bansley, 519 Vaughan Road, is erecting a brick residence estimated to cost $3,500.

Fort William, Ont.
N. Willey has prepared plans of a residence for John King, Victoria Street. Work to be done by day labor under supervision of the Architect. Frame construction, concrete foundation Estimated cost, $3,000

Flesherton, Ont.
James Vance, Durham Road, is preparing plans for a frame and brick residence estimated .to cost, $3,200.

Granville, N.S.
Fred Strong, Upper Granvill. contemplates rebuilding this residence and barn at an approximate cost of $4,000.

Hamilton, Ont.
Plans have been drawn for a residence to be erected on Wentworth Street by John McClement, 79 Leeming Street. Smaller trades will be sub-let. Brick construction, concrete foundation, shingle roofing. Approximate cost, $3,500.

Plans have been drawn by F. W. Warren, Bank of Hamilton Building, for a residence to be erected on Sherman Avenue by G. W. Ellis, 27 Sherman Avenue W. Smaller trades will be let. Estimated cost, $3,000.

Harrow, Ont.
Calvin Weston contemplates the construction of a residence to cost approximately $3,000.

Hensall, Ont.
Plans of two residences are being prepared by Thomas Welsh. Frame and brick construction, stone and concrete foundation. Eastimated cost, $5,000.

Dr. Bean is considering alterations to his residence.

R. Cudmore is considering the erection of a residence. Brick construction, stone and concrete foundation, shingle roofing. Estimated cost, $3,200.

Kingsville, Ont.
The erection of twelve residences on Lansdowne Avenue is proposed by H. Holt and O. Fox. Work will be started shortly on several of these. Frame and brick construction, shingle roofing.

Lambeth, Ont.
J. W. Woodhull is preparing plans of a residence estimated to cost $3,000.

Lucan, Ont.
Plans of a residence to cost about $3,500 are being drawn by John Coursey. Brick construction, stone and concrete foundation, shingle roofing.

Montreal, Que.
Laflamme & Bedford, 3137 St. James Street, have commenced the erection of a residence on Melrose Street. Brick construction, felt and gravel roofing. Estimated cost, $8,000.

S. Kauffman, Beaubien Street, is about to start work on the erection of two flats, estimated to cost $3,000.

L. R. B. Montbriant, 230 St. Andre Street, has prepared plans for five flats to be erected for O. Comtois, 188 Beaudry Street. Brick construction. Approximate cost. $3,500.

Work has been started on the erection of fifteen pairs of flats on Wilson Avenue for Hand & Pick, 609 Belmont Avenue. Approximate cost, $60,000.

Henri Demers, 188 Denormanville Street, is considering the erection of three flats on De La Roche Street, at an estimated cost of $3,500.

Oakville, Ont. a
Tenders have been received by W. Connery, 410 Manning Chambers, Toronto, for the erection of a residence here. Cut stone and pressed brick construction, shingle roofing.

Ottawa, Ont.
Prices are now being received by Louis Bangs, 18 Glen Street, on the painting, heating, plumbing and electrical work required in alterations to apartments on Metcalfe Street for Mrs. J. Cameron, 122 Argyle Street.

W. H. George, Architect, Castle Building, Queen Street, has prepared plans for alterations and additions to apartments on Gladstone Avenue for Alexander & Campbell, 245 Bank Street. Brick veneer construction, felt and gravel roofing. Estimated cost, $4,000.

Prices on heating, plumbing and electrical work required in the erection of three residences on Somerset Street are being received by R. Cohen, 106 Sweetland Street.

Oscar Beaudry, 163 York Street, is receiving prices on the heating, plumbing, and electrical work required in the erection of a residence for H. Condon, 544 Rideau Street.

John P. Yandon, 180 Hopewell Avenue, has prepared plans for a residence to be erected at an estimated cost of $5,000. Brick veneer construction, stone foundation, shingle roofing.

The erection of a residence on First Avenue is being considered by Wilbert Beament, 22 Maple Street. Brick veneer construction, stone foundation. shingle roofing. Estimated cost, $5,600.

The erection of a residence on Sherbrooke Street is contemplated by G. Cadeau, 393 Bank Street. Brick veneer construction, concrete foundation, felt and gravel roofing. Approximate cost, $3,800.

Outremont, Que.
Tenders are now being received by L. J. Bigonesse, Architect, 92 Notre Dame Street, on roofing, plastering, lathing, painting, heating, plumbing, and electrical work required in the erection of two residences on St. Joseph Boulevard for A. Boyer, 1058 Berri Street. Estimated cost, $4,000.

Palmyra, Ont.
Plans of a frame and brick residence estimated to cost $3,200 are being prepared by Philip Bieber.

Port Dover, Ont.
The erection of a residence is contemplated by Norman Holden, c/o M. M. Buck, Main Street. Estimated cost, $3,000.

Quebec, Que.
Work has been started on the erection of a residence on St. Raphael Street for F. B. Guilmet, 180 St. Therese Street. Material for painting, plastering, roofing, plumbing and electrical work will be purchased by owner. Estimated cost of work, $8,000.

A. Guilmet, 204 St. Therese Street, is building a residence on St. Raphael Street by day labor, and is in the market for material for painting and plastering. Tenders will be called for locally on roofing, plumbing and electrical work. Estimated cost, $7,000.

E. A. Tremblay, 69 St. Nazaire Street, has commenced the erection of a residence estimated to cost $18,000 Brick construction, concrete foundation, metal and asbestos roofing.

E. Belanger, 331 Fourth Avenue, Limoilou, has started work on the erection of a residence. Frame and brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

J. Lafond, 14 St. Lazaire Street, has commenced the construction of a frame and brick residence. Estimated cost, $6,000.

Seaforth, Ont.
Thomas Elder contemplates the construction of a frame and brick residence, estimated to cost $3,000.

Plans of a residence are being drawn by R Frost. Frame and brick construction, shingle roofing. Approximate cost, $3,000.

Strathroy, Ont.
Mrs. James Wright, contemplates the erection of a residence, at an estimated cost of $3,200. Brick construction, shingle roofing.

Thamesville, Ont.
Plans have been drawn for a residence to be erected on Anne Street for John Vance. Frame and brick construction, shingle roofing. Estimated cost, $3,000.

Toronto, Ont
J. T. Maybee, 1980 Dufferin Street, has commenced the erection of a pair of residences, estimated to cost $5.000. Smaller trades will be sub-let.

Work has been started by Weller & Passmore, Hilton Street and Melgund Road, on the erection of a pair of residences to cost $6,000. Smaller trades will be sub-let.

G. H. McLaughlin, 54 Hogarth Avenue, has commenced the erection of a residence at 51 Jackman Street. Brick construction, shingle roofing. Estimated cost, $4,000. Smaller trades will be sub-let.

Tenders on the erection of ten brick residences will be received by N. Caplan, 237 Augusta Avenue. Phone College 6820.

Work has been started by C. McKay, Roselawn Avenue, on the erection of a pair of residences on Appleton Avenue. Brick construction, shingle roofing. Phone Hillcrest 1689.

Work has been started on the construction of two pairs of residences at 6 to 12 Turness Street by F. C. Lankin, 265 Futon Avenue. Brick construction, shingle, felt and gravel roofing. Estimated cost, $6,000.

Plans have been prepared for two residences to be erected on Indian Road by J. M. Heale, 61 Oakmount Road. Tenders have been received for all trades required. Approximate cost, $5,000.

Roberts Bros., 241 Dovercourt Raad, are erecting apartments at 243 Dovercourt Road. The smaller trades will be sub-let. Estimated cost, $9,000.

W. H. Maton, 1723 Dovercourt Road, has commenced the erection of a residence at 933 Dovercourt Road. The smaller trades will be sub-let. Brick construction, stone foundation. Estimated cost, $3,5090.

Work has been started on the erection of a pair of residences on Metita Street by J. W. Grantton, 486 Clinton Street. Brick construction, shingle roofing. Approximate cost, $6,000.

J. Thorn, 221 Woodbine Avenue, has started work on the erection of a pair of residences on Bellefair Avenue. The smaller trades will be sub-let. Approximate cost, $4,000.

Wabash, Ont.
Work has been started on the erection of a brick residence by A. E. Norton. Estimated cost, $3,500.

Wallaceburg, Ont.
J. L. Wilson & Son, 7 Market Building, Chatham, are preparing plans of a residence for H. J. McDougall. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

Weston, Ont.
Baskerville Building Company, Mount Dennis, have started work on the erection of a residence on Holley Avenue, estimated to cost $4,500. Brick construction, concrete foundation, shingle roofing.

Winnipeg, Man.
The erection of a residence on Grosvenor Street is contemplated by L. H. Hall, 87 Lipton Street. Approximate cost. $8,000. 9

L. L. Lang, 62 Roslyn Road, is considering the erection of an addition to his residence estimated to cost $3,500.

J. Sangster, 521 Raglan Road, is contemplating the construction of a residence on Ethelbert Street at an approximate cost of $5,000.

Plans have been drawn for a residence to be erected on Ashland Street for M. Switzer. Estimated cost, $3,000.

S. Rackow, 615 McIntyre Block, has had plans prepared for two residences to be built on Garfield Street at an approximate cost of $18,000.

J. W. Parker, 473 Biresford Avenue, has had plans prepared for a residence to be erected on Rathgar Street. Estimated cost, $3,000.

Wolfville, N.S.
Work will shortly be started on the erection of a residence for Mrs. R. D. G. Harris. Estimated cost, $3,000.

CONTRACTS AWARDED

Carlisle, Ont.
E. Freed has let the contract for the erection of a residence to Henry Slater, Waterdown. Material will be purchased by owner. Estimated cost, $3,000.

Chatham, Ont.
The following contracts have been let in connection with three residences being built by John W. Spreque, Willowmac Avenue:—masonry and plastering, Frank Milburn, 79 Fielden Avenue; painting, John Crown, 27 Grey Street; plumbing, C. R. Bowes, Lecroix Slip; electrical work, Chatham Gas Company, 307 King Street.

T. Marshall, 234-248 St. John Street, Detroit, has let the contract for the construction of five brick dwellings on Elizabeth and Forest Streets to E. Prudhomme, 48 Gray Street, Chatham. Approximate cost, $1,500 each.

In connection with the erection of three residences on Elizabeth Street for Thos. Marshall, 248 John Street, Detroit, Mich., the following contracts have been let:—general contract, masonry and carpentry, E. Prudhomme, Lorne Avenue; plastering, A. C. Morgan, 20 Cornhill Street; painting, A. Burtch, 113 Releigh Street; plumbing, R. Mitchell, 185 King Street, and electrical work, Chatham Gas Company, 307 King Strete.

Charlottetown, P.E.I.
The general contract for an addition to the residence of C. L. McKay has been let to Gaudet, Morrison & Young, Morell House, and the heating and plumbing contracts to B. Stewart &

Hamilton, Ont.
F. S. Cooper. 15 Fairholt Road West, has let the general contract, masonry and carpentry, steel and roofing contracts for the erection of a residence on Fairmount Avenue to Cooper and Smith, 15 Fairholt Road. Estimated cost, $3,500.

Ilderton, Ont.
The general contract for the erection of a residence has been let by James Paisley, Concession 12, London Township, Ilderton P. O., to E. Douglas, Ilderton. Approximate cost, $3,500.

Kingston, Ont.
The general contract for the erection of a residence on Johnston Street for Martin James, 203 University Avenue, has been let to W. Randall, 42 Upper William Street. Brick construction, concrete foundation.

Arnold Squires, c/o Queen's College, has let a contract for the erection of a residence at Kensington and Edgehill Streets to W. McCartney, 250 University Avenue. Stone and brick construction, concrete foundation. Estimated cost, $3,900.

Lindsay, Ont.
A contract has been let to G. H. Lindsay, Box 104, Lindsay, Ont., for the erection of two residences at an approximate cost of $7,200. Brick construction, stone foundation, shingle roofing. Architect, H. C. Elliott, 1310 Lansdowne Avenue, Toronto.

London, Ont.
The general contract for the erection of a residence for C. S. Richardson has been awarded to Northey & Tulett, 825 Dufferin Avenue, and the plumbing contract to Eggett & Company, Clarence Street. Approximate cost, $4,000.

Montreal, Que.
Mrs. C. Huot, 136 Quesnel Street, has awarded the general contract for the erection of six flats on Vinet Street to A. Campbell, 190 Selby Street, and the roofing, heating and plumbing contracts to E. Millette, 239 Iberville Street. Estimated cost of work, $7,000.

New Westminster, B.C.
A contract has been let to Robinson Bros., for the erection of a residence on Third Avenue for Robert Moir. Frame construction.

Niagara Falls, Ont.
The general contract, masonry, carpentry, roofing, plastering and painting contracts in connection with the erection of a residence on Bamfield Street for Henry Marshall, Quebec Street, have been let to Alvin Smith, Southend P. O., Ont. Heating and plumbing not let. Estimated cost, $4,000.

Orillia, Ont.
The masonry and plastering contracts in connection with the erection of a residence for A. T. Reed, R. R. No. 3, Orillia, have been let to James D. Haywood, and the carpentry contract to P. C. Noy. Approximate cost, $4,000.

Ottawa, Ont.
The general contract for alterations to residences on Clarence Street for J. Courtemanche, 172 Clarence Street, has been let to N. Poirier & Son, 193 Cathcart Street. Contractors will purchase a large quantity of brick.

Outremont, Que.
A. Cloutier, 810 Durocher Street, has let the brick work for the flats being erected at 628 Oxford Street to Louis Drescoll, 86 Oxford Avenue. Other trades not let. Estimated cost. $13,000.

Quebec, Que.
The general contract and masonry contract for the erection of a residence for P. Paradis, 236 d'Aguillon Street, has been let to Emile Cote, 358 Richelieu Street. Concrete foundation, brick construction, metal and asbestos roofing. Approximate cost, $10,000.

Sarnia, Ont.
The general contract for the erection of a residence on Wellington Street for Dr. G. R. McGregor, Mitton Street, has been awarded to A. McColman, 120 Mitton Street. Plans have been prepared. Brick construction, brick and concrete foundation, shingle roofing. Estimated cost, $5,000.

Senneville, Que.
In connection with the residence being built for R. R. Macauley, Senneville, the roofing contract has been let to A. Binette, 52 19th Avenue, Lachine, and the plumbing contract to T. L. Bain, 31 Westminster Avenue, Montreal.

Thorold, Ont.
Richard Warner has let a contract for the construction of a residence on Carleton Street to Burley & Allan. Frame construction. Estimated cost, $3,000.

Toronto, Ont.
The contract for the erection of a residence at 2132 Queen Street E. has been let by Dr. W. F. Clarke, 2134 Queen Street E., to John Pay & Company, at $4,250. Brick construction, shingle roofing.

In connection with the residence being erected at 431 Indian Road for W. Grogan, 57 Hewitt Avenue, the masonry contract has been let to F. & A. E. Ham, 83 Salem Avenue, the plumbing contract to C. J. Corner, 43 Conduit Street, the heating contract to R. Stevenson, 172 Western Avenue, the plastering to James Lennox, 501 Roxton Road, and the painting to G. Latimer, 30 Grove Avenue. Carpentry to be done by owner.

The masonry contract in connection

(Continued on page 55)

Tenders and For Sale Department

NOTICE

Ideal Municipal Incinerator

Just completed this month at Berlin, Ont. Capacity, 25 tons. This is the most up-to-date plant of its size in North America. See this plant in actual operation before deciding on any other make, and you will gladly recommend the Ideal Incinerator to your community.

Write for full particulars.

Ideal Incinerator & Contracting Company, Ltd.,
No. 2 Manning Arcade Annex,
Toronto, Ont.

CORPORATION OF THE CITY OF WESTMOUNT

Tenders will be received for the paving of Grosvenor Avenue, Belmont Avenue, and Clarke Avenue.

Plans and specifications may be obtained at the office of the City Engineer upon deposit of $5.00 which deposit will be returned upon receiving bona fide tender and return of plans and specifications.

Tenders must be sent to the Secretary-Treasurer sealed and plainly marked "Tenders for Paving," not later than **12 noon, May 22nd, 1915**.

The Council does not bind itself to accept the lowest or any tender.

P. E. JARMAN,
20 City Engineer.

Tenders Wanted

Sealed tenders addressed to the undersigned and endorsed on the envelope "Tender for Ryerson School, Parry Island, Ont.," will be received up **to noon of the 8th day of June** next.

Plans and specifications may be seen at the Post Offices at Collingwood and Owen Sound, the office of Alexander Logan, Esq., Indian Superintendent, Parry Sound, Ont., and on application to the Department, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, for ten per cent. of the amount of the tender, payable to the order of the undersigned, which amount will be forfeited if the person or persons tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for.

The building to be fully completed and ready for occupation by the first day of September, 1915.

The lowest or any tender not necessarily accepted.

The unauthorized insertion of this advertisement in any newspaper will not be paid for.

DUNCAN C. SCOTT,
Deputy Superintendent General
of Indian Affairs.

Department of Indian Affairs,
—79562. Ottawa, May 3rd, 1915. 20

Tenders Wanted

Sealed tenders, marked "Tender for Public School Building," will be received up to **Saturday, May 29th**, by the Secretary of the Board of Education, Oshawa, in whole or part, for the different trades required in the erection and completion of an eight-roomed Public School Building.

Plans, specifications and all particulars can be had from D. Tod, Esq., Chairman of the Board of Education, Oshawa; also at the office of the Architects. No tender necessarily accepted.

P. PUNSHON,
Secretary Board of Education,
Oshawa, Ont.
ELLIS & ELLIS,
Architects,
Manning Chambers,
20-21 Toronto, Ont.

Tenders for Auxiliary Pumping Unit

Sealed tenders, endorsed "Tender for Pumping Unit," addressed to S. R. Armstrong, Esq., Secretary, Peterborough Utilities Commission, Peterborough, Ont., will be received until **noon of May 31st, 1915**, for the construction and installation in place of a complete Pumping Unit.

Tenders must be accompanied by a marked cheque as required by Specification.

Specifications may be obtained from the Secretary; address as above.

WM. KENNEDY, Jr.,
Engineer,
19-20 364 University Street, Montreal.

Department of the Naval Service

Tender for 30 Ton Steam Wharf Crane—Halifax Dockyard

Tenders addressed to the undersigned at Ottawa, and endorsed "Tender for Steam Wharf Crane, Halifax Dockyard," will be received up to noon of the **1st of July, 1915**, for the manufacture, supply and erection of a 30-ton Steam Wharf Crane, of the Derricking Jib Type, for the above mentioned Dockyard.

The tender should be accompanied by an accepted cheque in favor of the Deputy Minister of the Naval Service, on a chartered Canadian Bank, for $1,600, which cheque will be forfeited should the successful tenderer decline to enter into the contract as agreed, or fail to complete the work in accordance with the conditions of the contract and specification.

Representatives of firms desirous of tendering are to state in making application for specification, the name of the firm manufacturing and erecting the crane observing that sub-letting any portion of the contract is inadmissable.

The specification and conditions of contract may be seen at the office of The Consulting Naval Engineer, Ottawa.

Newspapers copying this advertisement without authority will not be paid for same.

The Department does not bind itself to accept the lowest or any tender.

G. J. DESBARATS,
Deputy Minister of the Naval Service.

Department of the Naval Service.
-79499. Ottawa, April 30th, 1915. 20-22

School Tenders

Tenders will be received at the office of W. Grayson-Brown, Architect, 204 Clyde Block, Hamilton, Ontario, until **June 1st, 1915**, for the erection of a public school and alterations and additions to high school at Whitby, Ontario.

Plans and specifications may be had at the above office. 20

COUNTY OF HALDIMAND

Good Roads Committee

Tenders will be received for the construction of at least ten reinforced concrete highway bridges varying in span from 6 ft. to 32 ft., on or before the **14th of June, 1915.** Plans and specifications may be seen and forms of tender obtained at the office of the County Engineer, Dunnville, Ontario, any day after the 1st of June, 1915. Tenders to be addressed to

Mr. BAIN, Chairman,
Good Roads Committee,
20-23 R. R. No. 1, South Cayuga, Ont.

CITY OF KINGSTON, ONT.

Tenders for Asphalt

Sealed tenders will be received by the undersigned up to **3 o'clock p.m., Monday, May 31st**, for 12,000 Imperial gallons, more or less, of Road Asphalt, for use in construction of Asphalt Macadam Pavement, delivered in barrels f.o.b. Kingston in car load lots as required.

Tenderers to submit with their tender a sample of, and analysis of, the asphalt they propose to deliver, duty paid.

Tenders must be accompanied by a marked cheque for $100.

The lowest or any tender not necessarily accepted

R. J. McCLELLAND,
City Engineer.
May 15th, 1915. 20

TENDERS

SUPPLIES

Tenders will be received through registered post only up to noon on **Tuesday, May 25th, 1915**, for the supply of:—

No. 53. Cedar Ties for Lansdowne Avenue Extension, Toronto Civic Railway.
No. 54. Five-Million Gallon Pump, driven by 3-phase Induction Motor, for the Riverdale Pumping Station.

Tenders must be addressed to the Chairman, Board of Control, City Hall, Toronto, and be plainly marked on the outside of envelope as to contents.

Specifications and forms of tender may be obtained at the Works Department, City Hall.

Tenderers must comply strictly with conditions of City By-law as to deposits and sureties as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.
Toronto, May 11th, 1915. 20

Road Machinery

Large U. S. firm making a special line of road drags desires to secure sales representatives in both Eastern and Western Canada who have good connections with municipalities and public contractors. Apply, Box 201, Contract Record & Engineering Review, Toronto. 19-21

TOWN OF WALLACEBURG

PROVINCE OF ONTARIO

Tenders for Water Works and Sewers

Sealed tenders will be received by the Town Clerk until **8 p.m. on Tuesday, June 1st, 1915,** for the following works:—

Contract "A-1"—Laying Water Mains.
Contract "A-2"—Laying Sewers.
Contract "O"—Laying Sewer Force Mains.
Contract "P"—Constructing Sewage Pumping Stations.
Contract "T"—Constructing Electric Transmission Line.

Plans and specifications may be seen at the Engineer's Office, Mail Building, Toronto, or at the Resident Engineer's Office, Wallaceburg, on and after May 15th.

The lowest or any tender not necessarily accepted.

T. B. DUNDAS, Esq.,
Mayor.
H. E. JOHNSON, Esq.,
Town Clerk.
CHIPMAN & POWER,
Engineers.
Toronto, May 10th, 1915. 19-20

The Quebec Streams Commission

Proposed Storage Dam on the St. Maurice River

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Storage Dam at La Loutre on the St. Maurice River," will be received at the office of The Quebec Streams Commission, Room 264, Parliament Building, Quebec, until **twelve o'clock on Tuesday, the 15th of June next, (1915).**

Plans and specifications can be seen on or after this date at the said office, or at the Quebec Streams Commission's office, Room 803, McGill Building, Montreal.

Parties tendering will be required to accept the fair wage schedule prepared or to be prepared by the Department of Labor of the Province of Quebec, which schedule will form part of the contract.

Tenderers are notified that tenders will not be considered unless made strictly in accordance with the printed forms.

An accepted bank cheque for the sum of One Hundred and Fifty Thousand Dollars ($150,000.00), made payable to the order of the Provincial Treasurer, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
O. LEFEBVRE,
Chief Engineer.
The Quebec Streams Commission,
Montreal, April 29th, 1915.

Newspapers inserting this advertisement without authority from the Commission, will not be paid for it. 20

Concrete Bridges

Tenders wanted for building
One 40-ft. concrete arch
One 30-ft. concrete arch
in Township of Waterloo. For further information apply to

BOWMAN & CONNOR,
Civil Engineers,
20 Berlin, Ont.

Tenders for Bridge Construction

Sealed tenders plainly marked as to contents will be received by the undersigned up to **noon of Monday, June 7th, 1915,** for the construction of a reinforced concrete beam bridge on Lansing Sideroad, first bridge, about one mile west of Yonge Street, in the Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Township Engineer.
Toronto, May 18, 1915. 20

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, May 28th, 1915
for

Jesse Ketchum School (New Building)

Niagara St. School—Terrazzo Flooring

Frankland School—Electrical Work

Manning Avenue School—Collapsible Gates

Sundry Schools—Cabinet Work

Sundry Schools — Plumbing

Sundry Schools—Local Telephones

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding Four Thousand Dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than **4 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

MILES VOKES,
Chairman of Committee.
W. C. WILKINSON,
20 Secretary-Treasurer.

FOR SALE

Concrete Mixer, 12 ft. cap. "The Standard" Low Charging on truck, with high-grade gasoline engine, complete. New; never been used. In stock at Montreal. Extra low price. Write for particulars. The Standard Scale & Supply Company, 1345-47 Wabash Ave., Chicago, U.S.A. 19-22

Tenders Wanted

Sealed tenders addressed to W. C. Livingston, Esq., Brantford, Ont., and marked "Tender" will be received up to six p.m., **Wednesday, June 9th,** for the erection of four-storey Departmental Store at Brantford, Ont.

Plans and specifications may be seen at the office of the Architects, the office of Contract Record, Toronto, or the office of the Proprietor, on and after May 24, 1915.

Each tender must be accompanied by marked cheque for 5 per cent. of contract price made payable to Proprietor.

The lowest or any tender not necessarily accepted.

ANGUS & ANGUS,
Registered Architects,
20 North Bay.

Residences

(Continued from page 53)

with the residence being built on Hutchinson Street by W. C. McQuillan, 110 Simpson Avenue, has been awarded to J. Howard. Brick construction, shingle roofing. Approximate cost, $3,200.

Westmount, Que.
The general contract for the erection of a residence on Montrose Avenue for Walter Dorken, Argyle Avenue, has been let to Hand & Pick, 609 Belmont Avenue. Concrete foundation, brick construction, green slate roofing. Approximate cost, $18,000.

Power Plants, Electricity and Telephones

Blenheim, Ont.
A by-aw has been carried providing for the installation of a Hydro-Electric lighting system at an estimated cost of $14,000. Town Clerk, P. S. Shillington.

Graytown, Sask.
B. Brouillet, Graytown, Secretary to West Graytown Rural Telephone Company, Limited, will receive tenders until May 22nd for (a) supply of material and construction complete, and (b) labor only for the installation of a telephone system. Specifications at office of Department of Telephones, Parliament Buildings, Regina.

Toronto, Ont.
The Miller Manufacturing Company will shortly be in the market for electric fixtures for their warehouse at 44 York Street.

Wawota, Ont.
The Wawota Rural Telephone Company are about to issue debentures to the amount of $7,300 for the construction of a telephone system. Secretary-Treasurer, J. Birnie, Wawota.

Winnipeg, Man.
The Board of Control will receive tenders until June 5th for the supply and installation of one 150 kw. motor generator exciter set at the Generating Station at Point du Bois. Specification at office of Engineer, J. J. Glassco, 54 King Street.

Fires

Chicoutimi, Que.
Fire has destroyed a store and residences belonging to Louis Boiley, J. Duperre and A. Bilodeau, with an approximate loss of $19,000. Owners will rebuild.

Three Rivers, Que.
Stores belonging to V. N. Lajoie have been destroyed by fire with a loss of $20,000. The occupants sustained the following losses:—Cyrille & Labelle Company, hardware, $20,000, and Larne & Chaine, dry goods, $15,000.

The Gres Falls Company's sawmill has been destroyed by fire. Estimated ed damage, $100,000.

Vancouver, B.C.
Fire has destroyed the Electric Laundry, 17th Avenue and Nootka Street.

Victoria, B.C.
The residence and garage of A. J. Woodward, North Quadra Street, have been destroyed by fire with a loss of approximately $12,000, covered by insurance.

West Templeton, Que.
The residence of Joseph Kerr has been destroyed by fire with a loss of $5,000. Owner will rebuild.

Willow Bunch. Sask.
Gagne Brothers' store has been destroyed by fire. Loss, $7,000, partially insured.

Miscellaneous

Colborne, Ont.
The Town Council contemplate the purchase of a power fire engine. Clerk, H. S. Keyes.

Deer Lake, Ont.
Cordova Mines Company, Limited, Cordova Mines, Ont., contemplate the purchase of a compression plant to replace that recently destroyed by an explosion, with a loss of $30,000. Manager, P. Kirkegaard.

Edmonton, Alta.
Work is about to start on the erection of a Roller Coaster in the Exhibition grounds for Lynn Welcher, c/o J. Stark, Civic Offices. Approximate cost, $15,000.

Halifax, N.S.
Tenders will be received until noon. June 1st by G. T. Bisbarats, Department of Naval Service, Ottawa, on the supply and erection of a 30 h.p. steam wharf crane of the derricking type for Halifax Dockyards. Specifications, etc., at office of Consulting Naval Engineer, Ottawa, Ont.

London, Ont.
Luitweiler Pump Company, 291 Dundas Street, contemplate the purchase of a plant for the manufacture of pumps.

Niagara Falls, Ont.
The purchase of gravel screening equipment is being considered by Stamford Sand Company, Southend Post Office, Ont.

Charles Connors, Niagara Falls Garage, Park Street, Niagara Falls, Ont., contemplates the purchase of a small air compressor and receiving tank.

North Lake, P.E.I.
Tenders will be received until 4 p.m.. June 4th by R. C. Desrochers, Department of Public Works, Ottawa, Ont., for the construction of a boat harbor here. Plans and specifications at offices of District Engineer, Charlottetown, and the Postmaster, North Lake. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto, Ont.

Construction will include a large quantity of lumber.

Oakville, Ont.
The Oakville Basket & Veneer Company, Limited, are in the market for one 40 h.p. engine to couple direct to line shaft.

Owen Sound, Ont.
McQuay Tanning Company, Limited, are about to purchase a horizontal high-speed steam engine of about 50 h.p.

Petrolia, Ont.
Alfred Kirkpatrick will be in the market shortly for a supply of cement.

Rodney, Ont.
The Town Council contemplate the purchase of additional fire equipment. Reeve, B. B. Graham.

St. Mary's, Ont.
The St. Mary's Wood Specialty Company, Limited, are receiving prices for genuine rock elm plank, 3¼ ins. thick, in car lots.

St. Thomas, Ont.
The City Council have ordered the construction 6 ins. and 4 ins. gas mains on various streets. Clerk, W. B. Doherty.

Tilbury, Ont.
The purchase of new fire equipment is contemplated by the Town Council. Clerk, W. Hutton.

Toronto, Ont.
The Board of Control will receive tenders until May 25th for the supply of 18,000 Hillside Vitrified Paving Block and one tank car of asphalt flux oil. Plans at office of Works Department, City Hall.

Waterloo, Ont.
The Park Board of the Town Council are considering the establishment of a swimming pool in the park. Clerk, James C. Haight.

Windsor, Ont.
The City Council are considering the purchase of one thousand feet of 2½-in. cotton rubber-lined hose and couplings, automatic electric door closers and a 100-gallon gasoline tank. Chairman of the Park Department, T. J. Eansor.

CONTRACTS AWARDED

Dorval, Que.
The general contract for the erection of a green house for R. J. Mercur, 20 St. Nicholas Street, Montreal, has been let to G. B. Mitchell, Jacobs Building. St. Catherine Street West, Montreal, and the contract for the mill work to W. Rutherford & Sons Company, Limited, Atwater Avenue, Montreal. Smaller trades not yet awarded.

Montreal, Que.
A conservatory is being built for W. Yuile, 89 Redpath Street, by McRobert & Gibeau, 10 Benoit Street.

Ottawa, Ont.
The contract for the construction of a chain of buckets for the dredge "Mastodon" has been let by the Department of Public Works, Ottawa, to Jenckes Machine Company, Limited, Sherbrooke, Que.

The Sunlight Oil Company of Canada have let the contract for the supply of tanks to the Campbell Iron & Steel Works, Carling Avenue.

Late News Items

Brandon, Man.
In connection with alterations to the store here for F. W. Woolworth Company, Limited, the contract for steel work has been let to Brandon Machine & Implement Works, and the carpentry contract to E. Willows. Approximate cost of work, $15,000.

Edmonton, Alta.
The City Council have let the contract for paving on Portage Avenue to Crown Paving Company, 11351 82nd Street. Approximate cost, $131,000.

Kingston, Ont.
Tenders will be received until 3 p.m., May 31st, by the City Engineer for the supply of 12,000 Imperial gallons of road asphalt, delivered in barrels f.o.b. Kingston. Sample to be submitted with tender.

The general contract for the erection of a residence at Kingston and Edgehill Streets for Prof. S. F. Kirkpatrick, 84 Gore Street. has been let to W. McCartney & Son, Earl Street, at $8,500.

Lockwood, Sask.
Tenders will be received until noon, May 22nd, by M. H. Waldron, Lockwood, for (1) labor and material complete, and (2) labor only for the construction of a telephone system. Plans and specifications at the Department of Telephones, Parliament Buildings, Regina.

Montreal, Que.
L. P. Forest, 347 St. Joseph Boulevard, has started work on the erection of three stores and apartments on Melrose Street. Architect, C. R. Gariepy, 25 St. James' Street. Estimated cost, $7,000.

Oshawa, Ont.
Tenders will be received until May 29th by P. Punshon. Oshawa, for the erection of an eight-roomed school here. Plans and specifications at offices of D. Tod, Chairman of School Board, and of the Architects, Ellis & Ellis, Manning Chambers, Toronto. Approximate cost, $30,000.

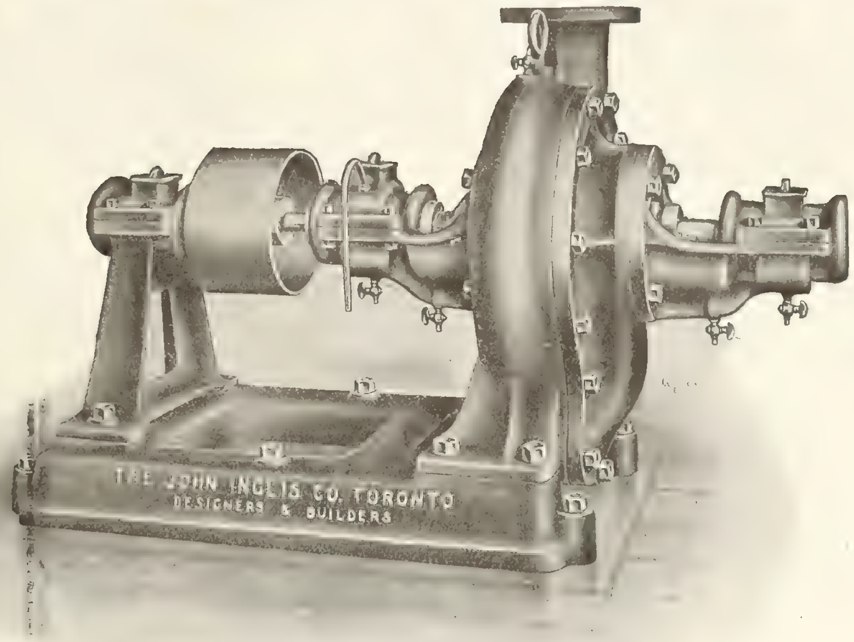
Quebec, Que.
In connection with the warehouse being erected on St. Andre Street for the Harris Abattoir Company, Limited, Quebec, the masonry contract has been let to Sharp Construction Company, Quebec, and the roofing contract to E. Falardeau, Dorchester Street. Other work to be done by general contractor. Approximate cost, $10,000.

The contract for heating, plumbing and electrical work in connection with the residence being built on Cortier Avenue by N. Couchon has been let to P. Paradis, d'Aguilon Street. Estimated cost, $12,000.

Toronto, Ont.
The Board of Control will receive tenders until May 25th for two portable crossovers, right and left hand, complete with 15,000 feet of 60-lb. T rail for special track work. Plans, etc., at office of Works Department, City Hall.

Tyvan, Sask.
J. Simpson, Tyvan, will receive tenders until May 29th for (1) labor and material complete, and (2) labor only for the construction of a rural telephone system here. Plans and specifications at Department of Telephones, Parliament Buildings, Regina.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

INGLIS' PRODUCTS ARE "MADE IN CANADA"

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The John Inglis Company, Limited

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14 Strachan Ave., Toronto, Canada
Montreal Office: Room 509 Canadian Express Building
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Barrett Specification Roofs

(Made in Canada)

A Modern Warehouse and a Modern Roof

Here is a picture of The Barrett Specification Roof on the George J. Foy, Limited, warehouse in Toronto.

Cut through this roof at any point and you will find alternate layers of pitch and felt, for the method of procedure in the laying of the roof is so carefully defined in The Barrett Specification that, if it is followed, it is not possible to find any spot in the roof which does not have its full quota of pitch and felt.

This type of roofing was selected for the building because its first cost is lower than that of any other permanent form of roof covering and the cost of maintenance is absolutely nothing.

This combination of low first cost and no maintenance cost explains why there are **more** Barrett Specification Roofs on permanent structures than any other kind.

Another important feature is the fact that Barrett Specification Roofs take the base rate of fire insurance. In case of fire from within they form a continuous air-proof fire blanket.

All first-class structures, such as city dwellings, office, railroad and commercial buildings of all kinds should have Barrett Specification Roofs as a matter of real protection and sound economy.

Special Note

We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired, however, the following is suggested:

ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August **15, 1911**, using the materials specified and subject to the inspection requirement.

A copy of The Barrett Specification, with roofing diagrams, free on request.

THE PATERSON MFG. CO., Limited

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George J. Foy, Limited, Warehouse,
Toronto, Ont.

Roofers: Reggin & Spence,
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Sheeting
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STANDARD STEEL CONSTRUCTION CO.
LIMITED
WELLAND - CANADA
MANUFACTURERS AND ERECTORS

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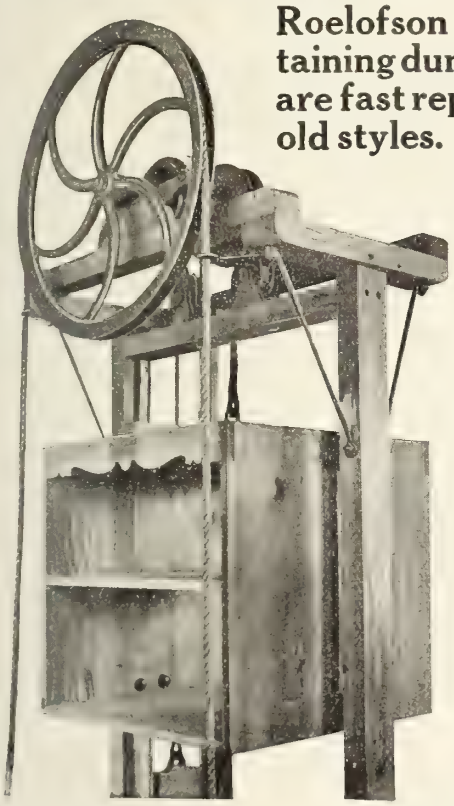
DUMB WAITERS

Roelofson self retaining dumb waiters are fast replacing the old styles.

They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of cost for special machines to be used as wall hoists, freight or invalid elevators.

Roelofson
Elevator
Works
Galt, Ont.



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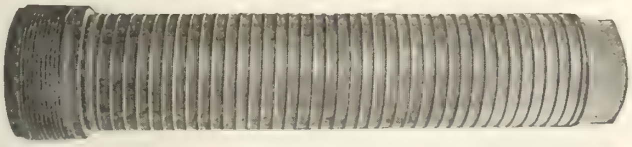
& TANK CO., LTD.



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See our new patented Wood Pipe Coupling—Positively LEAK PROOF.

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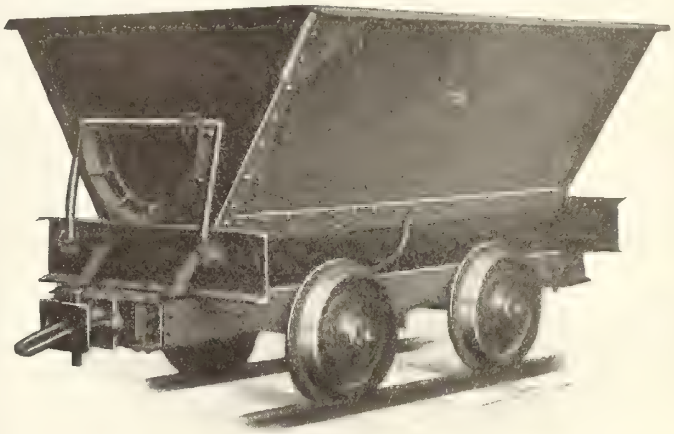

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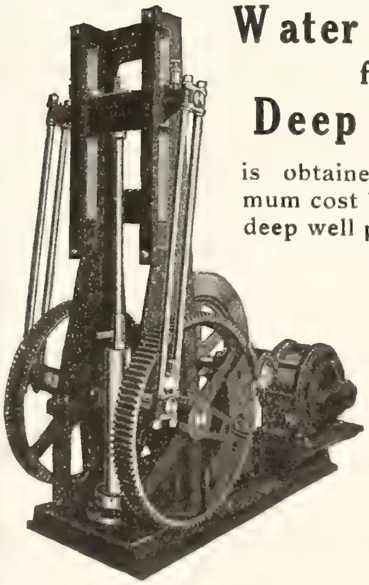
Let us Quote on Your Requirements.

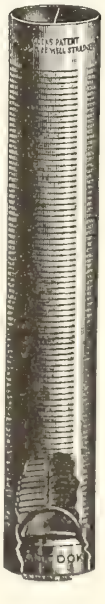
Marsh & Henthorn, Limited
Belleville, Ontario

Water Supply from Deep Wells

is obtained at a minimum cost by use of our deep well pumps.

Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer





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Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS**, Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

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The **HAMILTON BRIDGE WORKS** Co.
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STEEL BRIDGES FOR STEAM RAILWAYS, ELECTRIC RAILWAYS HIGHWAYS, ETC., ETC.

FOR FACTORIES, OFFICES, WAREHOUSES POWER STATIONS, MILL BUILDINGS OR ANY OTHER PURPOSES **AND BUILDINGS**

ANNUAL CAPACITY 36,000 TONS, Shop "A" 18,000 Tons, Shop "B" 6,000 Tons, Shop "C" 12,000 Tons
STEEL BRIDGES AND BUILDINGS

The Glue Book

What it Contains:—

Chapter 1—Historical Notes
Chapter 2—Manufacture of Glue
Chapter 3—Testing and Grading
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Chapter 5—Glue Room Equipment
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Price 50 cents.

Contract Record
and Engineering Review
347 Adelaide St. West - Toronto

Water Purification

RANSOME
Drifting Sand Filters

THIS system has been accepted by the City of Toronto after a thorough test, and a plant having a daily capacity of 60 million imperial gallons is now under construction. The filters can be installed in either the gravity or pressure systems.

Designs and estimates furnished on application.

John verMehr Engineering Co.
Limited
154 Simcoe Street, Toronto

The Canada Iron Corporation, Limited

Head Office
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MONTREAL

Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

Note Convenient High Lift

The photograph shows a contractor's Browning crane with steam shovel boom. Note the high lift under the dipper door which enables the contractor to keep his horses and wagon conveniently out of the way. This high lift is a distinctive feature of the Browning crane and is an advantage that is appreciated by men experienced in excavation and construction. This one feature of the

Browning Locomotive Crane

allows the operator to perform operations possible with no other crane—and this is but one of the distinctive Browning features. Let us furnish you free of charge photographs and data on work similar to yours. Write

The Browning Co.
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Sales Offices:
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STANDARD at the Exposition

A fairly representative display of STANDARD Wires and Cables and Cable Accessories is on exhibit at the Panama-Pacific International Exhibition at San Francisco.

If you are there we will be glad to welcome you at our booth in the Palace of Machinery and would request that you give your name to the attendants.

Standard Underground Cable Co.
of Canada, Limited
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Montreal, Que. Winnipeg, Man. Seattle, Wash.

RAILS **New and Relaying Switches, Turntables, Etc.**

Carried in Stock

Locomotives and Cars

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HERRINGBONE COPPER ALLOY LATH

The Herringbone Policy

On account of its fireproof qualities the use of Metal Lath should be greatly extended. Two things prevent this—cost, and the possibility of corrosion.

Our Sherardized coating prevents corrosion but increases the cost. Our cold japanned coating is economical and generally efficient, but leaves the steel unprotected at points where it becomes scratched. Our latest Herringbone improvement, the use of copper alloy instead of steel, reduces corrosion at scratched places to a negligible amount.

This improvement, adding greatly to the manufacturing cost of Herringbone Lath, is not being used as the occasion for any advance in prices. By reason of this generous policy Herringbone Copper Lath becomes the final word in the metal lath industry.
Alloy

Clarence W. Noble - General Sales Agent
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Metal Shingle & Siding Company Manufacturers

To Secure

ECONOMY* and *DURABILITY

Construct Your

SEWERS

from

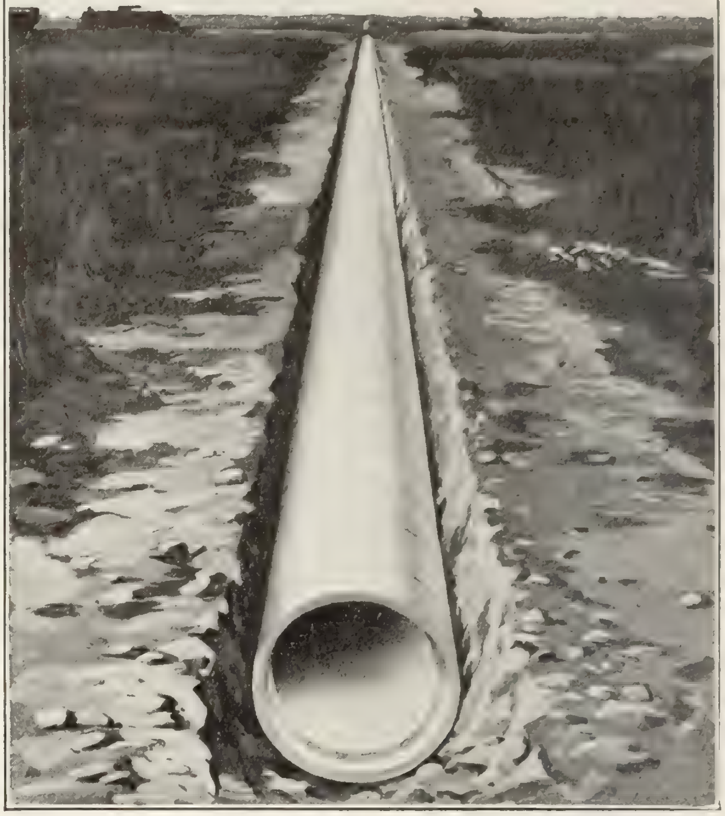
Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.



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is the most complete line of practical Road Machinery made in Canada

GRADERS

Panama Giant (traction) 3300 lbs.
Panama Standard (6 horse) 2800 lbs.
Panama Boston (2 or 4 horse) 1000 lbs.
Panama Jr. Improved (2 horse) 600 lbs.

SCRAPERS

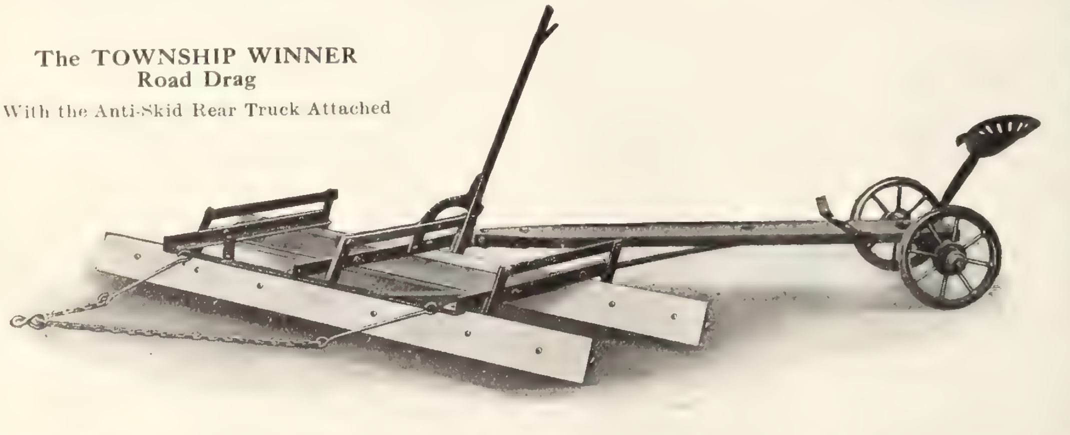
Panama Drag Scrapers Panama Wheeled Scrapers

DRAGS

3-Way Drag No. 1 3-Way Drag No 2
Township Winner, 8 ft. Township Winner, 7 ft.
Panama No. 1 Panama No 2 Simplex

CAST IRON AND CORRUGATED CULVERTS

A FULL LINE OF CONCRETE MACHINERY



The TOWNSHIP WINNER
Road Drag
With the Anti-Skid Rear Truck Attached

THEY ARE ALL SAYING THE SAME

"Last Spring we purchased from the Exeter Mfg. Co., Limited, one Panama Jr. Improved Grader and one Township Winner Drag with truck. The members of our Council Board were all surprised that this grader would do the heavy grading that we did with it. This is all the road machinery we have in our town and we have been able to keep our streets in excellent condition with the use of these two machines."
(Signed)
Reeve of Teeswater.

If you want Service, Get the PANAMA JR. IMPROVED. Don't Get the "Just as Good."

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The Exeter Mfg. Co., Limited, Exeter, Ont.

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Getting Your Money's Worth In Pavements

is not determined by first cost but by performance.

Suppose a Trinidad Lake Asphalt pavement does cost 15 cents a yard more than an oil asphalt pavement.

What of it? So far as experience shows, one Trinidad pavement will outlast three oil asphalt pavements.

Isn't Trinidad worth the difference in cost?

TRINIDAD LAKE ASPHALT

In a sheet asphalt pavement the grading, foundation, stone, sand and labor and other costs are the same whether you use Trinidad asphalt or a "cheap" substitute. The asphalt only forms 10 per cent of the surface mixture.

Why jeopardize the whole investment by "saving" a few cents on the asphalt?

The best in the long run is never the cheapest in the first instance. But considering the service obtained per dollar expended Trinidad pavements are the **best** as well as the **cheapest**. Their record proves it. Ask for "Evidence".

The Barber Asphalt Paving Co.

Philadelphia, Pa.

Make This Simple Test

The Slab

Send for a slab of Ceresitized cement or concrete and make the following, interesting test:

Put this test slab into a tumbler of water—keep it there a week, a month or a year. Then take it out and break the slab and note that there has been absolutely **no** penetration of water—a result that would be impossible without effective waterproofing.

Or we will send you the different materials separately and you can make your own waterproofed slabs.

The most perfect concrete and cement work contain voids. Water naturally penetrates these and carries a deposit of foreign matter which lodges in the voids and sets up a chemical action which causes disintegration. CERESIT makes passage of water impossible and resists capillary attraction and force of gravity.

The Test

CERESIT Waterproofing Compound is a plastic paste that readily mixes with the water used to temper cement or concrete, thus insuring uniform distribution throughout the entire mass.

Unlike water-repellant powders, CERESIT does not retard hydration, therefore, cannot affect structural strength of the mass.

Highly Instructive

This test will convince you of the unusual merits of CERESIT for permanently waterproofing all kinds of cement and concrete work. Our own waterproofing specialists cooperate with you in every way.

Write for the slabs.

Ceresit Waterproofing Company

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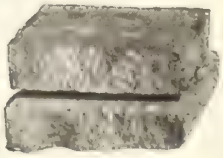
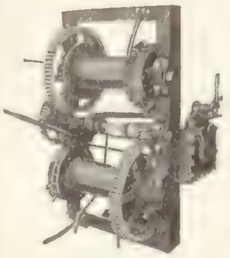


The Broken Slab—
Absolutely Bone-dry.

The Result

STEAM and AIR ENGINES, HOISTING ENGINES, STEAM CRANE HOISTS, MOTOR CRABS, SWINGING ENGINES, DRILL HOISTS, SPUD HOISTS, MARINE MACHINERY

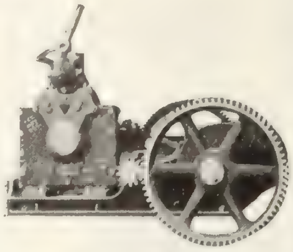


Motor Crab

Write for catalog and prices

Dake Engine Co.

Grand Haven, Mich.



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Sand, Gravel and Crushed Stone

Lime
Cement
Plaster
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Our prices are right and our service good.

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During the past few months we have supplied ornamental lighting standards for the following places:—

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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

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The contract for the new Half Million Dollar Civic Library at Montreal has been awarded in

"Queenston Blue" Limestone

Specify and get the best Canadian Stone.

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Towers and Tanks for all purposes.

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Water supply outfits of every description.

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Do your part—keep your money "at home"

Now of all times the suggestion of using only Canadian-made building materials should have double force. Keep the "Metallic" catalogues beside you and correspond with us—you'll find we meet your every need promptly and economically with goods that are CANADIAN OR BRITISH MADE THROUGH AND THROUGH.

The "Metallic" line includes "Eastlake" Steel Shingles; "Empire" Corrugated Iron; Steel Siding, Ceiling and Wall Plates; "Hayes" Patent Lath; Skylights; Ventilators; Galvanized or Copper Cornices; Fire-proof Doors and Windows; Well Curbing; Culverts; Conductor pipe and Eave-troughs.

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Manufacturers—Toronto & Winnipeg

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Manufacturers of the well-known

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Main Office - 90 West Street
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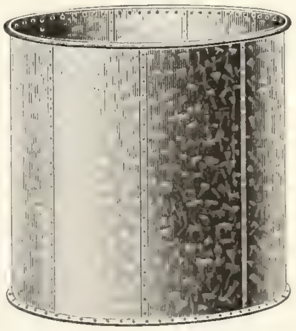
Galvanized Steel Tanks



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Prices quoted promptly on heavy galvanized steel tanks for every purpose.

Wayne Measuring Systems for handling your gasoline and oils will save you money.

Wayne Oil Tank & Pump Co.
Limited
Woodstock, Ont.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5 barrel lots, $1.85 per bbl; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $21; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22; No. 2 Hemlock, dimension and 1 in., $19 to $21.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $42; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $27; No. 1 pine decking D 2 S, $28; spruce decking, $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casin, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $3.40 to $4.50; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.40; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $4.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto proces (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.5d to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 81c. per gal of 9 lbs.

Raw linseed oil—in bbls., 78c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bbls., 73c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.50; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $3.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.60; 28 gauge, $3.25 per sq. yd. net cash. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.85 per 100 lbs.; Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in.. $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14½c basis per pound; British manilla, 12½c basis; African hemp, 12½c; sisal rope, 10½c basis; lath yarn, 9¾c. Boiled linseed oil—in barrels, 82½c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; bandsawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

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Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 30 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $35 at warehouse, $33 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35; fire clay, $12 per ton.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $5.35 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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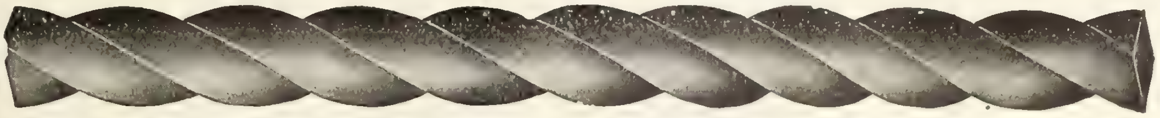

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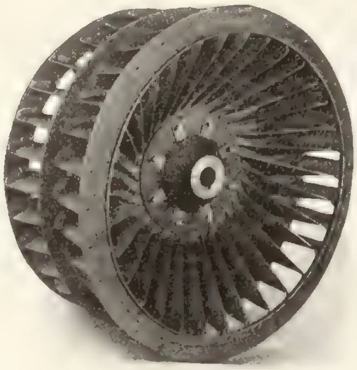

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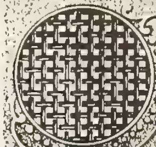

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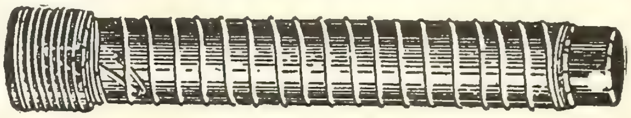

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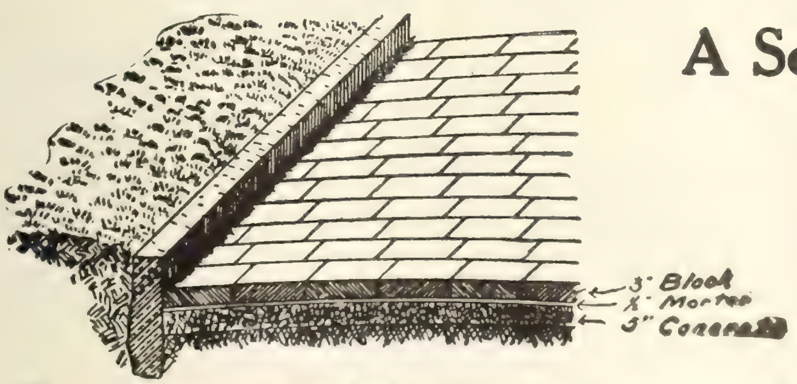

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Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

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Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

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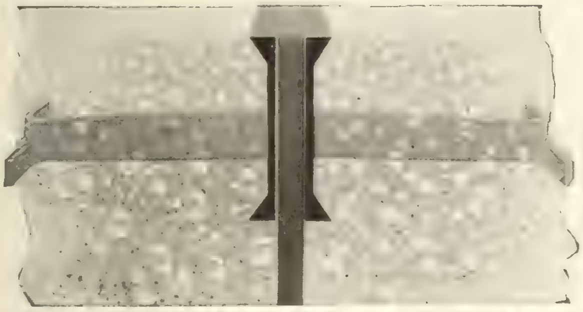
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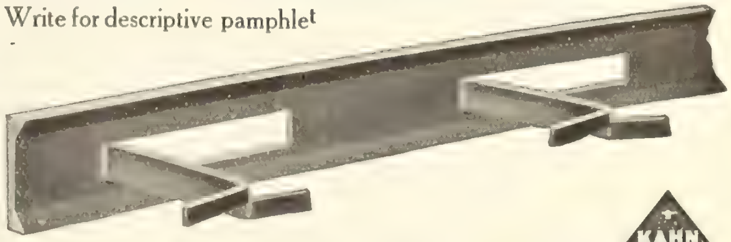
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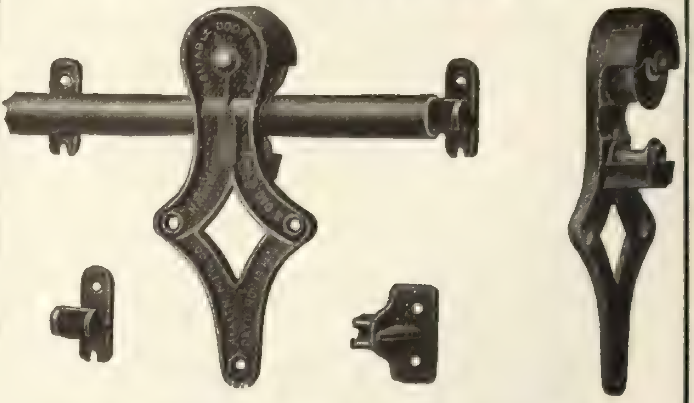

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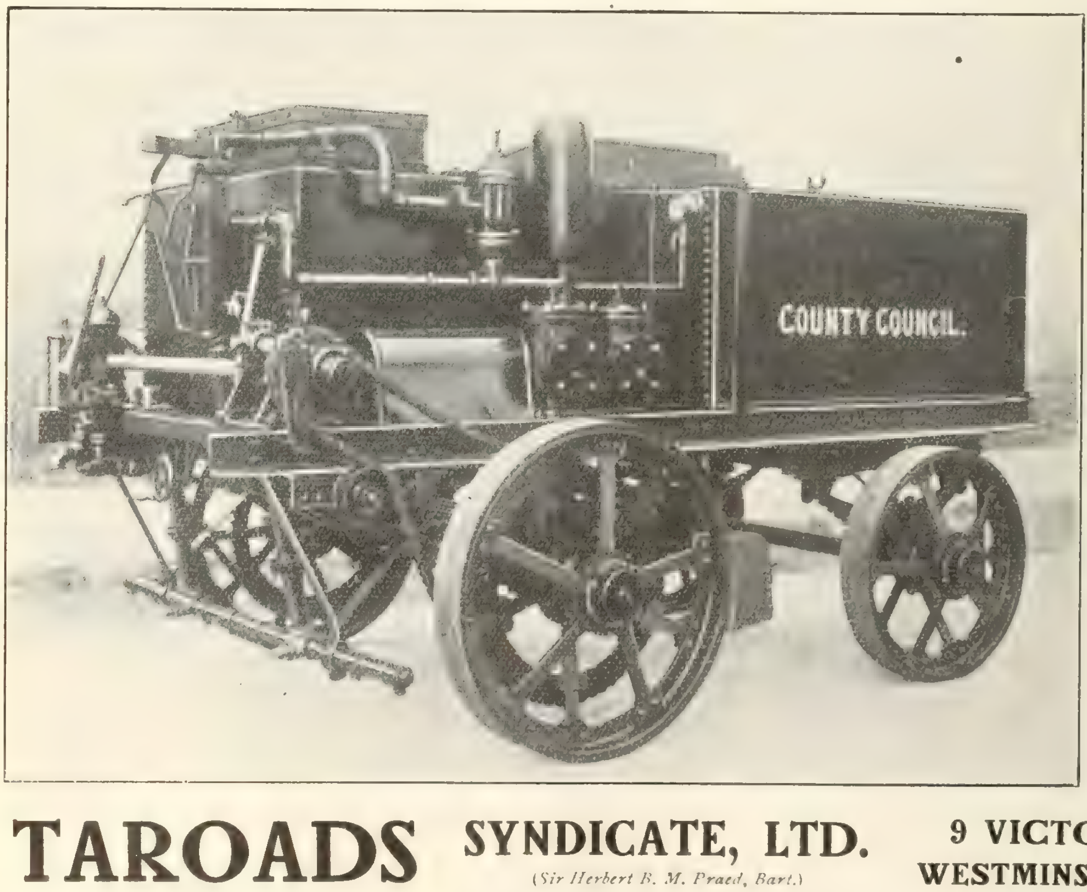

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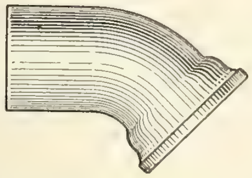

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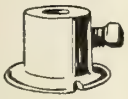

Fig. 1

Fig. 2

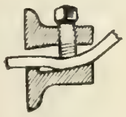

Fig. 3

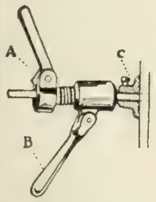

Fig. 4

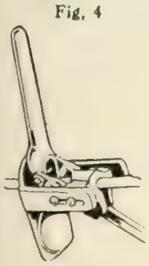

Fig. 5

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The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section, showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screws tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

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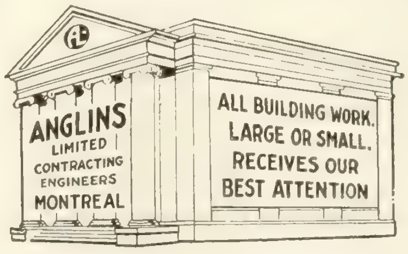

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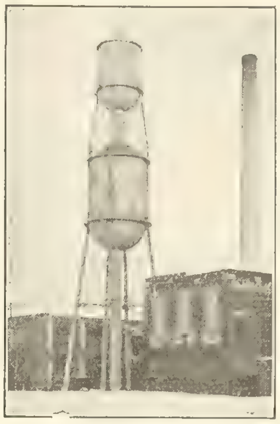

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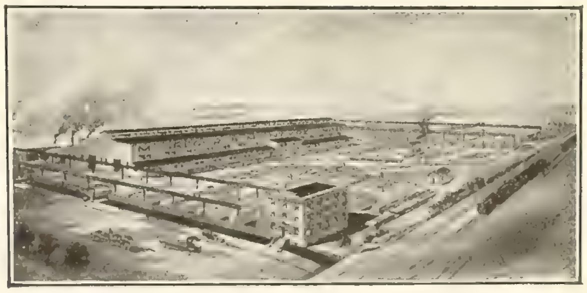

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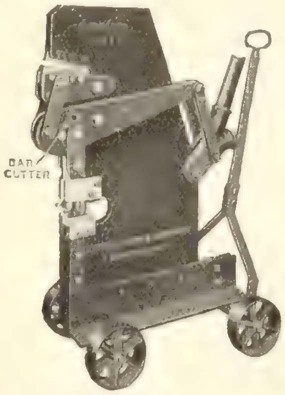

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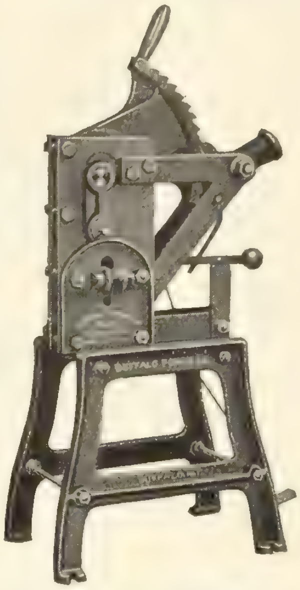

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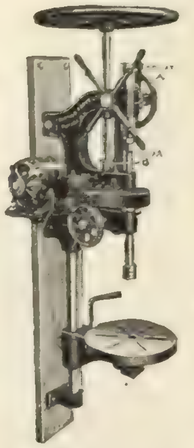

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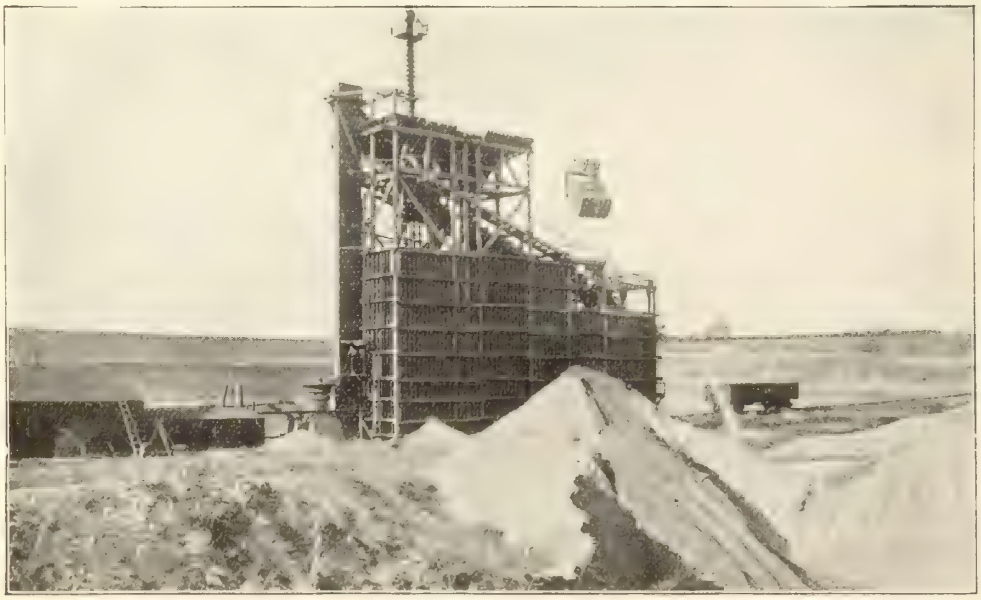

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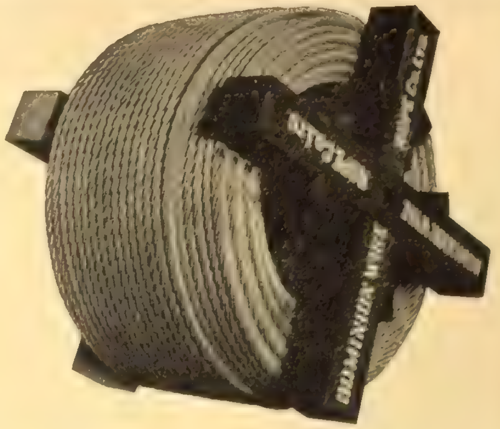

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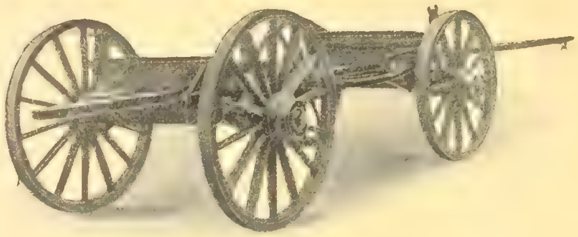

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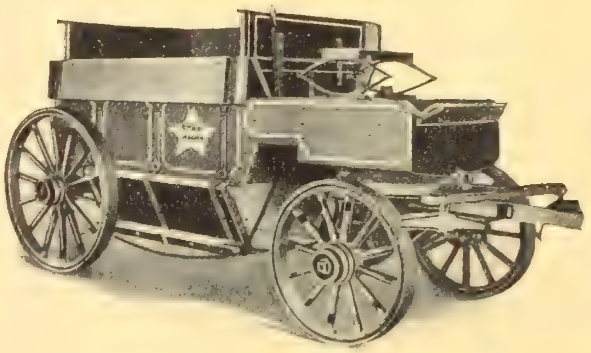

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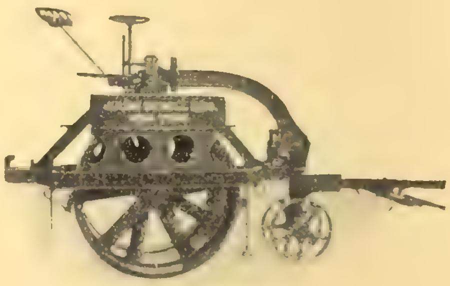

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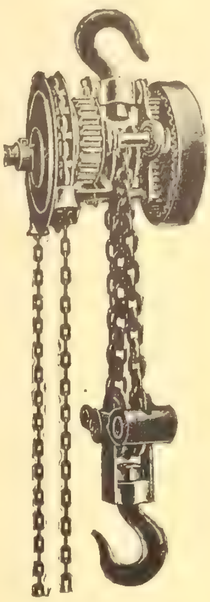
Spiedel Chain Hoist



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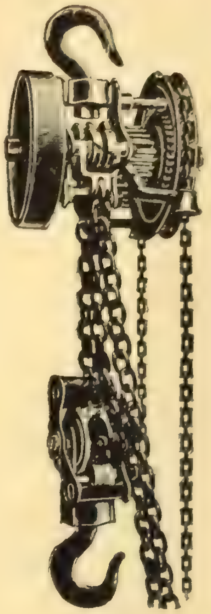

Fig. 2
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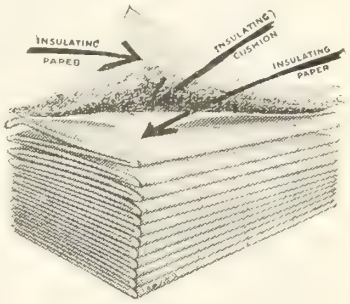

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Cement Waterproofing
Ceresit Waterproofing Co.

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De Laval Steam Turbine Co.
E. Laurie Company.
Turbine Equipment Company

Ceresitol
Ceresit Waterproofing Co.

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Morris Crane & Hoist Co., Herbert

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Turbine Equipment Company

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Manitoba Bridge & Iron Works

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Goold, Shapley & Muir Co.
Hopkins & Co., F. H.
Lecky & Collis
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Woodstock Concrete Mach. Co.

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Dake Engine Company
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Hamilton Mfg. Co., Wm.
Lecky & Collis
Marsh & Henthorn
Morris Machine Works
Montreal Locomotive Works
Railway Contractors Supply Co.
Stinson-Reeb Builders' Supply Co.
Sudbury Construction & Machinery Company

Contractors' Flare Lights
Sudbury Construction & Machinery Company

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Canadian Equipment Company
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Pedlar People

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Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

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Canadian Equipment Company
Hopkins & Co., F. H.
Manitoba Bridge & Iron Works
Marsh & Henthorn
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Sheldons Limited

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Canadian Equipment Company
Deere Plow Co., John
Tiffin Wagon Co.
Watson Wagon Co.

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Can. Consolidated Rubber Co.

Electricians' Plugs
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Canadian Ingersoll-Rand Co.

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Gent & Company

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Chelsea Elevator Company
Roelofson Elevator Works
Turnbull Elevator Co.

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Hopkins & Co., F. H.
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Chipman & Power
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Galt Engineering Co., John
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McDougall, Geo. K.
Pullar, H. B.

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American Water Softener Co.

Filtration Plants
verMehr Engineering Co., John

Fire Brick
Smyth & Ryan

Fire Escapes
Manitoba Bridge & Iron Works
McGregor & McIntyre

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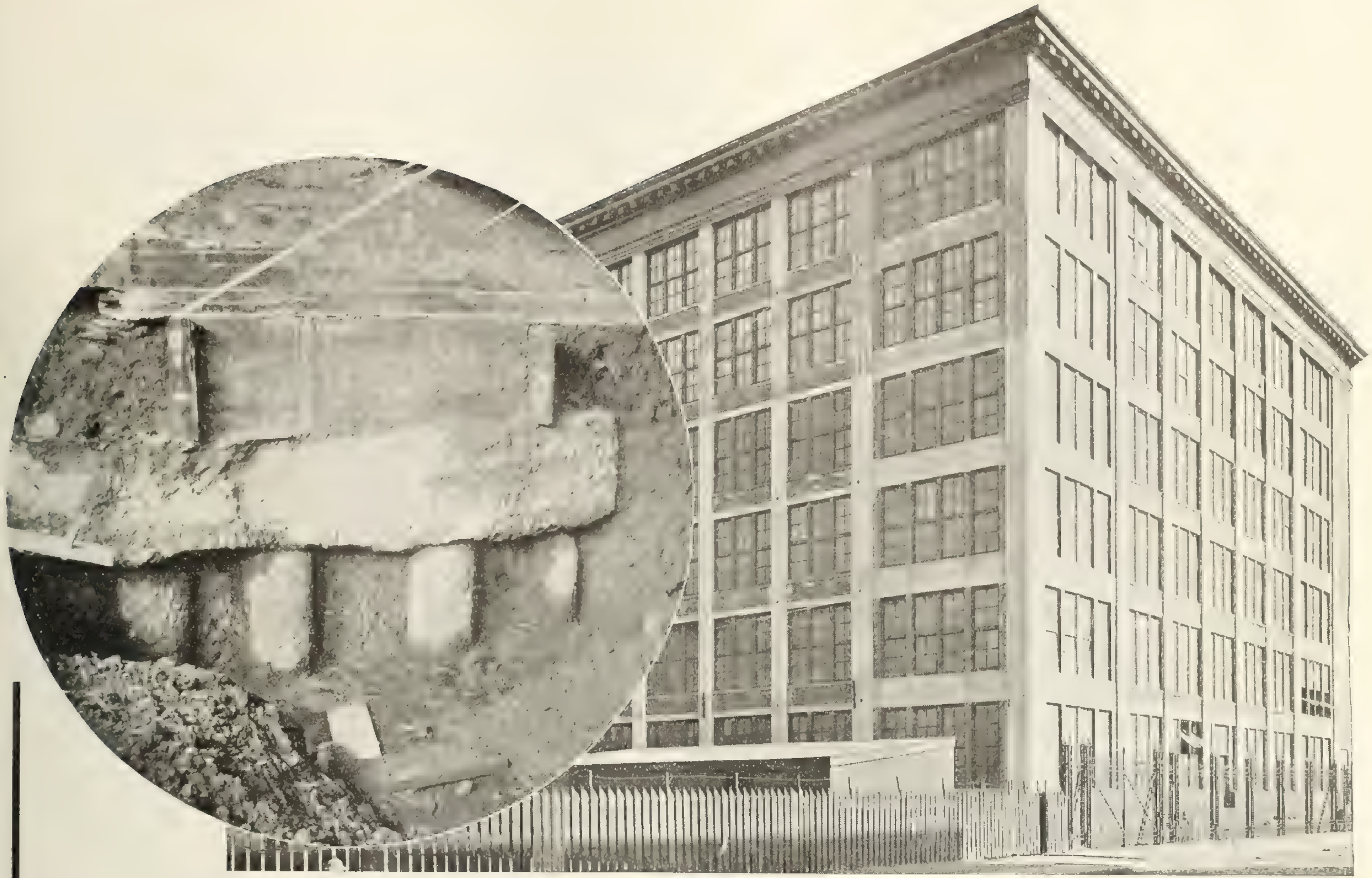

Drive to Firm Footing and Bond to the Soil

THE SIMPLEX SYSTEM comprises three methods which are adapted to any soil conditions. The distinguishing feature of all of them is **penetration.** You can get your piling down to bed-rock or solid footing. Simplex Piles are **straight piles** and compress the soil uniformly from ground surface to pile point.

The illustrations show the cabinet shop building of the Victor Talking Machine Company, at Camden, N. J.; 493 Simplex Standard Piles support this building. When the plant was extended in 1912, Simplex Piles were used again. The excavation made for the new building furnished another evidence of the bond developed between the Standard SIMPLEX Pile and the surrounding soil. Simplex Piles have been in service 11 years.

For docks, wharves and other waterfront work the SIMPLEX MOLDED PILE, a strongly reinforced concrete pile, is set on a couple of feet of fresh concrete placed in the bottom of the driven Simplex shell. SIMPLEX MOLDED PILES **require no driving or jetting.**

Over half the concrete piles in the world are SIMPLEX PILES.

The Simplex does not depend upon skin friction for its strength. It drives to a firm footing first, then it takes full advantage of the skin friction developed by cementing itself to the surrounding soil.

The STANDARD Simplex Pile which is adapted to most soil conditions and is generally used, comprises a heavy steel shell with a detachable point which is driven preferably with a drop-hammer. This shell drives quickly and easily. It stands the strain of heavy driving. When it finally brings up, the form is filled with soft concrete and then pulled out, leaving the point in the ground. The concrete, forced down at the bottom by its own weight, completely fills the hole and cements itself to the **evenly Compressed** ground all the way down.

The "Composite" Pile is designed to cheaply meet soil conditions requiring great penetrations.

There is a SIMPLEX PILE for every job.

Write for the useful illustrated reference book, "Simplex Concrete Piling."

Simplex Concrete Piling Company of Philadelphia

Canadian Representatives

Simplex Construction Company, Limited

Coristine Building, MONTREAL

"Simplex Piles Drive to Firm Footing"

Fig. C 21. Mantel Clock

ARTISTIC MERIT

as well as accuracy in Time-keeping is embodied in all Pulsynetic Electric Clocks. No matter whether they are to be fixed in the Residence, Office, Factory, Warehouse, or Tower, we have the correct design at the right price.

One master transmitter controls any number of dials, irrespective of size or position and never wants winding.

Architects, Engineers and all interested in Correct Time should send at once for our Book Five, or full particulars and prices may be obtained from:—

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442 Sherbourne St.
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Gent & Co., Ltd.
Leicester, Eng.

Cables, Lodestone

KERR

Gate Valves

and

Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

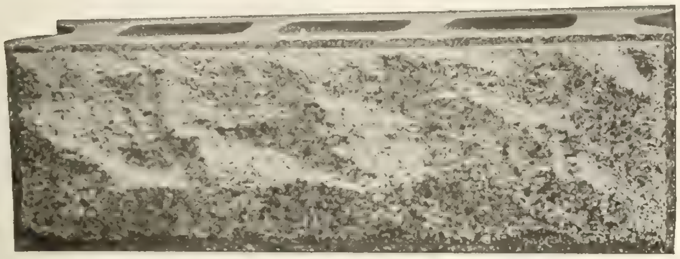
Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO



Molds for Casting

Waterproof Hollow Cement Building Blocks

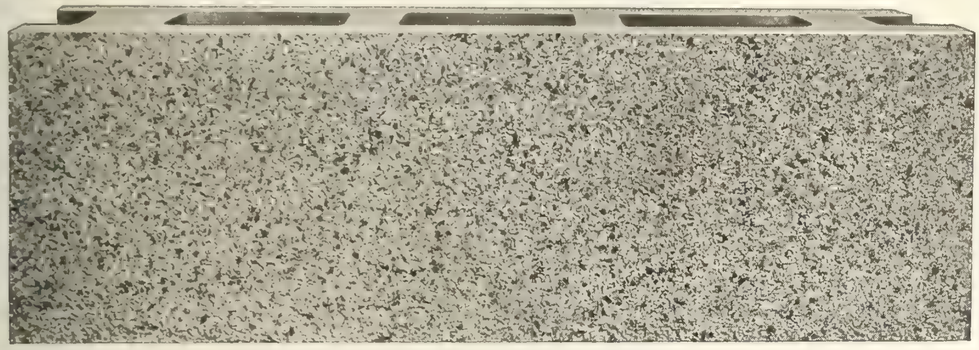
With Granite Faces

THEY COST LESS — THEY SELL FOR MORE

YOU SELL MORE OF THEM

8 x 8 x 24 inch Granite Rock Face Block

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited (Zagelmeyer System)

298 Howard Avenue, WINDSOR, ONTARIO

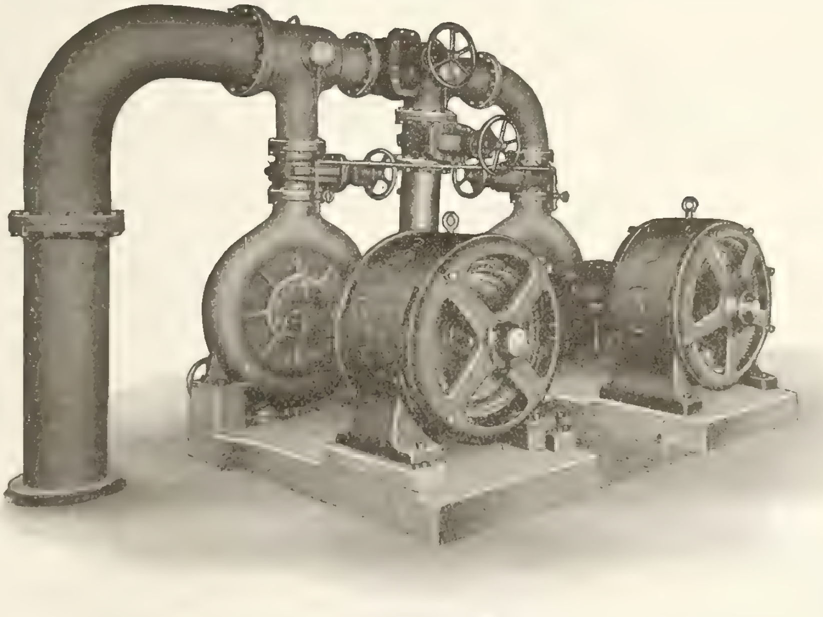
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL
CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

To Secure

ECONOMY* and *DURABILITY

Construct Your

SEWERS

from

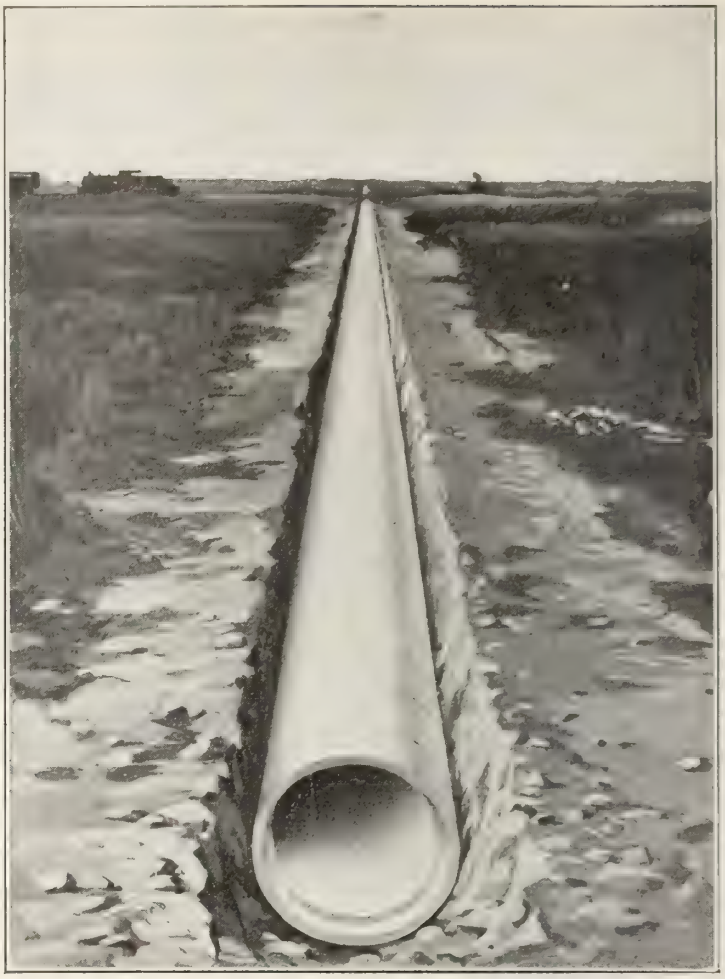
Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.



High Calcium Lime

Manufactured by

The Dominion Lime Company,
SHERBROOKE, - - PROVINCE OF QUEBEC

Its Special advantages are:

Strength,
Whiteness,
Purity

Builders admit that our Lime takes more sand and is therefore cheaper to use.

Shipped in Bulk or Barrels.

Will give 25% better results to CONTRACTORS, PAPER MANUFACTURERS and OTHERS, than the ordinary lime.

TRADE MARK

Hull Iron & Steel Foundries, Limited

Head Office and Works - HULL, QUEBEC

Manufacturers of Steel Castings

Chrome, Manganese and Nickel Steel Castings

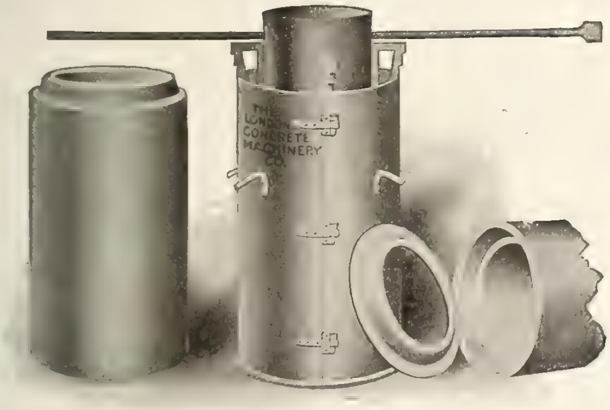
Annealed and Unannealed

Repair parts for Stone Crushing Plants, Mining Machinery and Cement Mills our specialty.

Machine Moulded Gears

any size up to 18 feet in diameter made without patterns.

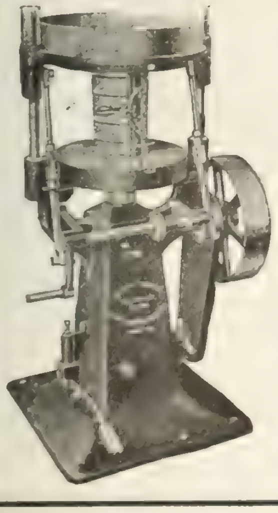
We solicit your patronage and prompt attention will be given to any orders.



London Tile and Sewer Pipe Moulds

Made in all sizes from 4 inches to 10 feet in diameter and in lengths and designs to meet every requirement.

The best moulds are the cheapest. Write for catalogue N.2B.



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There are large profits in the Cement Drain Tile Business. We make three sizea of machines and entire equipment for the plants. Send for Catalogue No. 2.

LONDON POWER DIAPHRAGM PUMP

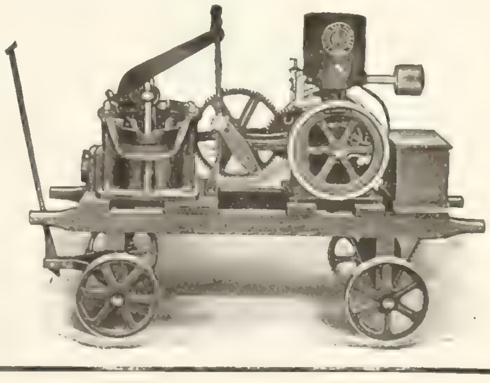
This Pump will do as much work as 8 men can on a hand operated pump at a cost of 15c per day for fuel.

We make all kinds of Contractors' Pumps.
Write for Catalogue No. 4B.

London Concrete Machinery Co.
LONDON, ONT. Limited

Branches and Agencies in every large city in Canada.

World's Largest Manufacturers of Concrete Machinery and Cement Working Tools.



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Fireproof Doors and Windows
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Ormsby Company, A. B.
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Trussed Concrete Steel Co.

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Marsh & Henthorn
Morris Hoist & Crane Co., Herbert
Pollard Mfg. Company.
Pawling & Harnischfeger.

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Metallic Roofing
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National Iron Works
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United States Cast Iron Pipe Co.
Vancouver Wood Pipe & Tank Company
Warren Foundry & Machine Co.

(Continued on Page 14)

Another Letter—
And Another Installation

Messrs. Saxe & Archibald whose letter to our Montreal agents is here reproduced, specified the G & G Telescopic Hoist for the La Sauvegarde Building.

In Montreal alone, a number of the most prominent buildings are equipped with the G & G Telescopic Hoist

SAXE & ARCHIBALD
Architects
314 Dorchester St. W.

MONTREAL. Feb. 2nd, 1915.

Messrs. B. & S. H. Thompson & Co. Ltd.,
Transportation Building,
M o n t r e a l.

Gentlemen:-

We have found the G. & G. Telescoric Ash Hoist, which we have used in our practice, a convenient and efficient devioe and feel that it fills a distinot want in building squipment.

Yours truly
Saxe & Archibald

The G&G PATENTED Telescopic Hoist
with compound gear and brake attachment

Raises a maximum load of 500 lbs. at a speed of 30 feet per minute, operated from sidewalk. Clean, safe and noiseless in operation. Only ash hoist with which it is practical for one man to perform entire removal of ashes.

"Made in Canada"

Write to nearest agent for illustrated Booklet and Prices

GILLIS & GEOGHEGAN, Sherbrooke, Que.

Black Building Supply Co., Ltd. Agents for Ontario **Toronto**
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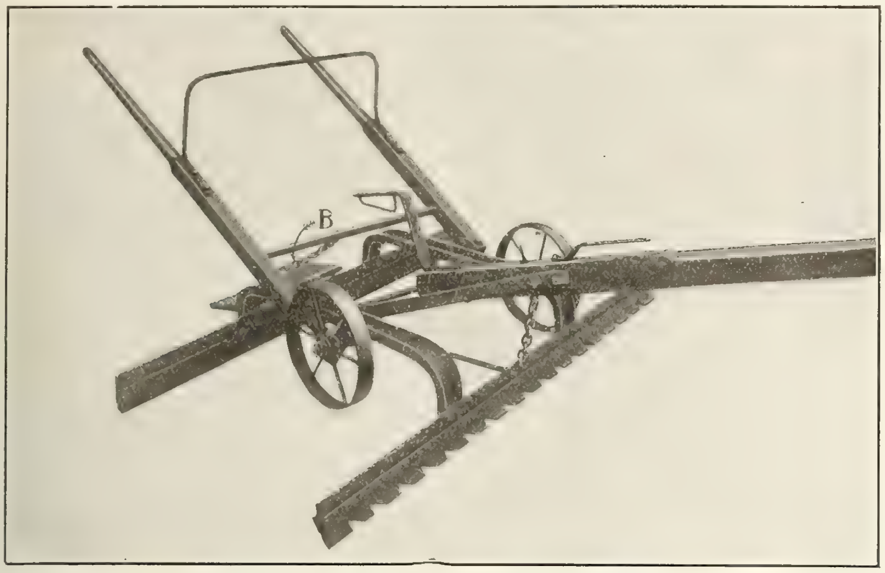
"MADE IN CANADA"



SHOWING MACHINE IN OPERATING POSITION

CHAMPION

ROAD LEVELER

As a simple, durable, convenient and complete appliance for leveling and truing country roads, it would be hard to imagine a more satisfactory machine than the CHAMPION Road Leveler as shown in the accompaning illustration. This machine is used and endorsed by road makers who demand the best and most practical tools.

Write for Descriptive Bulletins and Our Prices.

TRADE **CHAMPION** MARK

CHAMPION ROAD AND STREET MACHINERY

A most complete line of all Machines for the Road Contractor as well as for towns, townships, and municipalities in general

Manufactured by

American Road Machine Company of Canada, Limited, Goderich, Ont.

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Marsh & Henthorn, Limited

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- Canadian Ingersoll-Rand Co.
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- Smart-Turner Machine Co.
- Turbine Equipment Company

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- Goodwin, Barsby & Company

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- Dominion Iron & Steel Co.
- Pedlar People Limited
- Steel & Radiation Ltd.
- Trussed Concrete Steel Co.

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- Exeter Mfg. Co., Ltd.
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- Lecky & Collis
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- Bishopric Wall Board Co.
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- Paterson Mfg. Co.
- Pedlar People Limited

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- Canada Wire & Iron Goods Co.
- Dull Company, Raymond W.
- Goodwin, Barsby & Company

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- Canada Iron Corporation
- Dominion Sewer Pipe Co.
- Gartshore Thomson Pipe Co.
- London Concrete Machinery Co.
- National Iron Works
- Ontario Sewer Pipe Co.
- Smyth & Ryan
- Standard Clay Products Ltd.

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- Canadian Equipment Company
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- Montreal Locomotive Works

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- Pedlar People Limited

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- DesMoines Bridge & Iron Co.
- Hamilton Mfg. Co., Wm.
- MacKinnon, Holmes & Co.
- Manitoba Bridge & Iron Works
- Pittsburgh-DesMoines Steel Co.
- Pedlar People Limited

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- Sheldons Limited

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Made in Canada

ARTIFICIAL MARBLE is a material manufactured by a new process. The ARTIFICIAL MARBLE is harder than natural marble, is less absorbent and is susceptible to a higher finish. The coloring is non-fading and runs entirely through the marble.

ARTIFICIAL MARBLE is polished (not varnished) in the same manner and with the same material as natural marble.

ARCHITECTS:—Patronize a home industry and specify ARTIFICIAL MARBLE made by a Canadian firm, and with Canadian material.

We manufacture ARTIFICIAL MARBLE in all the beautiful colorings of the Italian, Greek, French and Belgian marbles, and the well known Canadian and American marbles, and our facilities are adequate to turn out the largest contracts.

Specify ARTIFICIAL MARBLE and avoid delays caused by the unsoundness of natural marble quarries.

Manufactured by

J. E. CARREAU

Office and Factory, 13 Notre Dame St., East
Phone Main 5539—Connecting All Departments
MONTREAL

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

Penstock at plant developing 96,000 h. p., painted with "D.P.W. Special Penstock Paint."

PENSTOCK PAINTS

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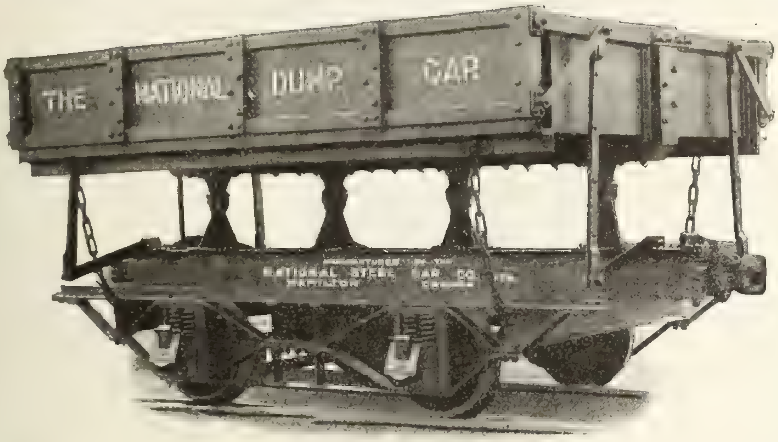

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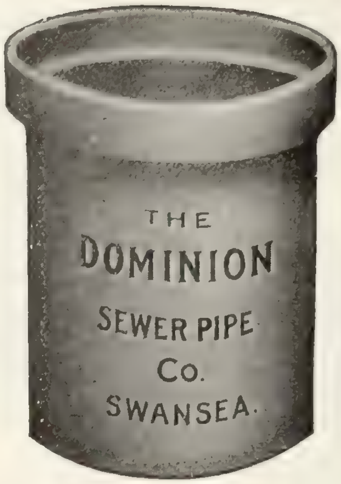

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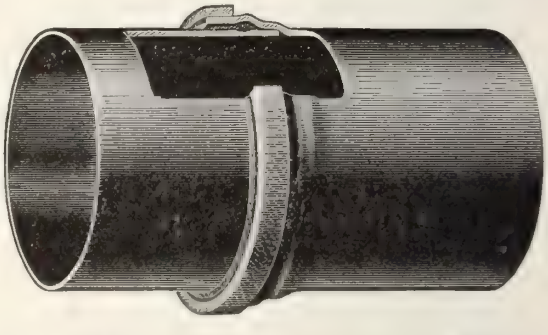

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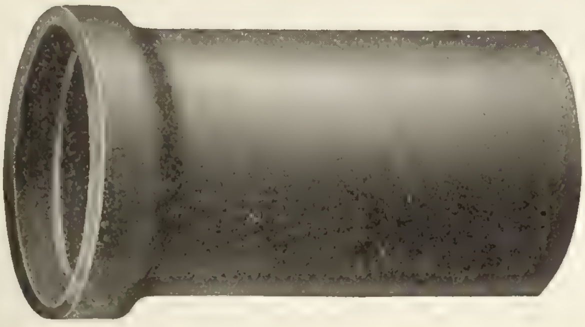

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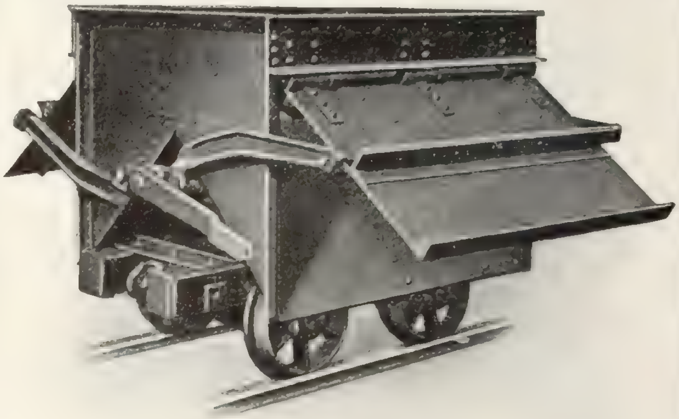

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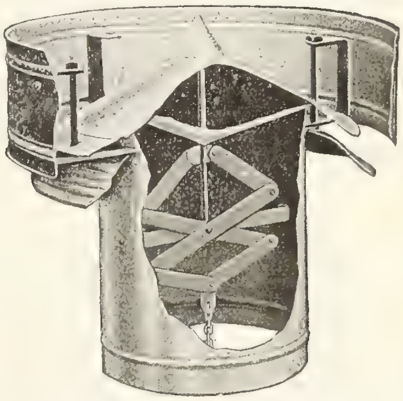

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Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

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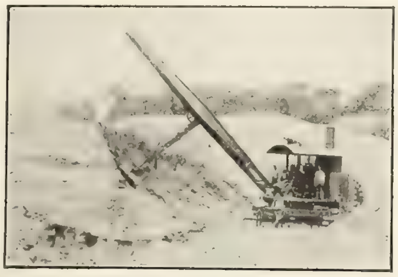

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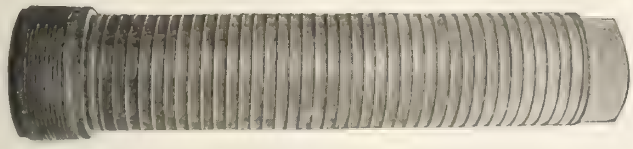

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A Period of Watchful Acting

It is a far cry from old London to Edmonton in the Canadian West, but distance sometimes intensifies the things we have in common. Points of common agreement will be found in the letters by Messrs. Gorman, Clancey & Grindley and Mr. W. A. Mountstephen, of London, England, published in this issue. The outstanding principle to which they both subscribe is the economy and general wisdom of putting constructional work in hand now, at a time when conditions are more favorable to the building owner than they have been for years.

We are too prone to surrender our ambition and enterprise to the idea that this is a period of "watchful waiting;" rather should it be a period of watchful **acting**. This is a strenuous day, in which the whole world is undergoing a process of remodelling. In the very nature of things, conditions can never be the same again, and we must adapt ourselves to the requirements of the hour. Many there are who are watching and waiting without contributing a turn of their energy and resources to the wheels of the Empire's business. Supposing Great Britain had committed herself to a period of watchful waiting when the Kaiser and his hordes swept over Belgium and made for Paris—the national flag of the Devil would now be floating over the Parliament Buildings at Ottawa.

Those who cannot fight should at least take an active—yes, and a strenuous—part in promoting the activities of the country. In our field we are committed to constructional activity, and each one of us can exert an influence which will tend to encourage building rather than to discourage it. At the risk of weary reiteration, let us remind the man with money to build that materials are at rock-bottom, that labor is plentiful, and that contractors are tumbling over themselves to get work. Let us bear in mind that every undertaking put in hand at a time like this provides employment for those to whom employment is vitally necessary, and that it exerts an upward influence tending to encourage others to follow the same example; while, on the other hand, every contract cancelled, every constructional undertaking postponed, contributes to the sum-total of unemployment and exercises the minds of others unfavorably. Great though the trial through which we are passing, there must come an end to this hateful conflict, and the ensuing days will be days of prosperity—marked prosperity for those who have hung on—for those who have counted optimism and confidence more worth while than pessimism and dull despair.

The call to-day in the business world, as in the military world, is for the best. Always we need strong men—men strong in brain and brawn, strong in devotion and principle, in confidence strong, and in work strong.

Out of the Wilderness

There was a man of a philosophical turn of mind who once made quite a reputation for himself by writing a little treatise upon efficiency, in the course of which he said something to the effect that if a man could make something which the public wanted, and make it a little better than anyone else, the world would make a beaten path to his door, even though he lived in a wilderness.

This is a pretty sort of a statement, but it does not work out in practice. If you have made something which the world wants, and made it a little better than any one else, you are still a long way from getting the world to use it. You must get upon the house-tops and shout about it so long and so loud as to make the public curious. Unless you do they will not buy. They will not make any beaten path to your door, even though it be located at the most expensive corner in your town, but they will go to the merchant in a back street for a substitute material, if he has been wise enough to understand that the general public not only want goods to fill their requirements, but at the same time want to be persuaded by argument and oft-repeated announcement that they are getting the best value for their money.

The facts of the case as regards the actual merits of the goods have much to do with securing and holding the trade, but no matter how good your wares may be they will not bring you sufficient trade to keep the bailiff away unless you let the consumer know about them and do something in the way of educating the consumer to a proper appreciation of their merits for fulfilling his particular requirements.

Engineers as Viewed by Contractors

By Richard W. Sherman*

COMPLETE harmony cannot exist between engineers and contractors, as each represents opposing interests. The engineering graduate starts with an educated prejudice against contractors, whom he believes to be, in the main, determined to get the best of engineers; and therefore he is on his guard, and purposes not only to take care of himself but to get the best of the contractors.

Contractors dread the "boy engineer" just from college. These young engineers are extremely technical. They expect a literal compliance with every iota of the contract obligations by the contractor.

With rare exceptions, men greatly improve in learning, wisdom, and disposition as they grow older. After twenty or thirty years, a man is surprised to find how little he knew when he started his professional or business career. He has grown riper in judgment, and has developed greater caution, discretion, and justice towards others. He grows considerate, amiable, and kind.

Contractors are largely influenced by their opinions of engineers. The engineer who has a reputation for ability, honesty, fairness, and good disposition will attract bidders for any work of which he has charge; and the desire to do work under him would be an incentive to reasonably low prices. It is a feature of contracting to size up the engineer with as much accuracy as possible.

In bidding for work, contractors are almost as sensitive as weather-vanes. It may be possible to make a profit at a given bid under one engineer, and impossible to avoid a loss under some other engineer, with all other conditions similar, and the quality and the merits of the work constructed being equally good at the same cost to the owner in each case.

A majority of bids are too high. The highest bid is often twice as much as the lowest, even when the lowest is sufficient. Over-anxiety to secure the contract is the commonest cause of low bidding. Low bids are often made to keep a contractor's organization together for future work on which he hopes for better prices.

Contractors who do not care for the contract often bid fairly high up, without any expectation of securing the contract, but merely to avoid a reputation among contractors of being low bidders, and with the bare chance of getting the work at good prices. Excessively high bids are usually the result of lack of knowledge of the value of the work and lack of time to become familiar with it.

If an engineer's preliminary estimate is believed to be too low, it drives away bidders and tends to indifferent, high bidding. Some over-anxious contractors may be influenced thereby to bid too low. They may secure the work, in which event the engineer has an unpleasant task during construction. There is almost sure to be a disposition on the part of the contractor to save himself from loss, and he is thus tempted to slight the quality of the work. Both contractor and engineer are in some degree injured by the work having been done at less than cost.

An engineer who can make reliable preliminary estimates will find his services in demand by municipalities, corporations, and other owners; or, if he chooses to practise as a contractor's engineer, he will find his services of great value in that field. Some prominent engineers of my acquaintance would not under any circumstances do engineering work for contractors, confining their services entirely to the owners. I know of other engineers who confine themselves wholly to engineering for contractors, and who do a large business as engineering experts for contractors, in litigations.

These two fields of engineering are becoming more and more distinct, and it is my opinion that an engineer is wise who makes his choice and adheres strictly either to the one line of practice or to the other.

The contracts and specifications on very large and important works are usually models of perfection. In smaller works, such as may amount to, say, not over $200,000, contractors are often confronted with bidding papers, contracts, specifications, plans, etc., which are a disgrace to the engineer who drew them.

There are a few engineers who are sometimes called "specification fiends." They write to many places where work is advertised, for specifications, etc. They read them eagerly and often clip such paragraphs as catch their fancy—usually those which are harsh, severe, and unreasonable from a contractor's standpoint. With these clippings to aid them, they draw up specifications, etc., which often deserve the name of "crazy-quilt" specifications. Such papers are full of contradictions, useless paragraphs, and ambiguities which are almost sure to cause contention and trouble during the construction and in the final settlement, or lead to litigation. Such engineers are apt to insert severe conditions such as excessive cash deposits with the bids, unreasonably short time in which to construct the work, excessive per diem liquidated damages for overtime, excessive bonds, and sometimes excessive retained percentage where monthly payments are provided. About all they can think of is to make the work undesirable and objectionable to contractors. Such engineers and their work are often avoided by the best class of bidders, and the contracts are apt to go to rather undesirable contractors.

---

* Chief Engineer of the New York State Highway Commission.

LETTERS

Chlorination of Water

Ottawa, May 14th, 1915.

Editor, The Contract Record:

I wish to point out that, although the short abstract on "Chlorination of Water" appearing in the May 5 issue of your paper is generally correct, there is one misstatement. I am credited with the opinion that hypochlorite treatment with calcium hypochlorite is the most practical method of purifying the Ottawa River. This is quite contrary to my present opinion, however, and to all that I have said in the past, as I believe that chlorination should be regarded merely as a temporary expedient when used alone, though it is of great utility when used as an adjunct to other forms of purification for increasing the factor of safety.

The point under discussion in Montreal was "the most economical and efficient method of chlorination." and I gave reasons for the opinion I hold that calcium hypochlorite, when properly applied and thoroughly mixed with the supply by mechanical methods, is just as efficient as, and much more economical than, liquid chlorine. As I pointed out, many of the plants using bleach are not using the material on hand to the full advantage, whereas newer installations of liquid chlorine are so designed as to reap the advantage of the past failures of others.

Hoping that you will give publicity to this correction.

Yours truly,

JOSEPH RACE,

City Bacteriologist and Chemist.

* * *

Western Contracting Firm Find "Much to be Thankful For"

Edmonton, May 17th, 1915.

Editor, The Contract Record:

In reply to your inquiry as to building prospects in this locality, we may tell you that, while general business conditions are not normal by any means, there is still much to be thankful for in the West. Last year we had good crops, which realized good prices; and the prospects for the present season are good.

In this section of the country, particularly, the building trades are not in a very promising condition—that is to say, as far as houses and speculative blocks are concerned; but just the same there are hundreds of people who will see the wisdom of building now, and benefit accordingly. The farming proportion of our community is the most envied. The farmers are in the best position to improve their houses and build new ones.

As you say in The Contract Record, this is the time to build. Of course, nothing is cheap unless needed; but one can tell the townspeople that if they have been paying rent, and have any money, they should BUILD NOW, and own their own home. One can give the "BUILD-NOW" advice to the farmer who has been living in a shack and housing his family less comfortably than his stock.

We know of nothing entering into the constructional business that is not cheaper now than it has been for years before. It is not necessary to commit oneself to buying; let him ask for prices on material and labor, and see to what a low level the dollar sign has descended.

Yours very truly,

GORMAN, CLANCEY & GRINDLEY, LIMITED,

* * *

An Old Country Viewpoint

16 Regent Street, London, England.
May 12, 1915

Editor, The Contract Record:

I have followed with much interest recent discussions in your paper—notably the one on trade development, but there is one subject which offers great and useful possibilities, particularly in such an issue as your forthcoming Annual Number. The subject may be summed up in two words which it is in the interests of the constructional field to impress upon the public—BUILD NOW. It would be impossible to devote too much attention to such a campaign, and if a number of your influential readers were to submit their views for editorial comment the discussion could not fail to carry much weight.

It is not sufficient to tell the financial interests that building materials are cheap, that labor is plentiful, and that contractors want work. These things are true, but there are even more compelling reasons. It is estimated that in the United Kingdom the contracts suspended on account of the war represent some hundred million pounds. When the war is over this work will go forward, and the demand for material will be enormous. In addition there will be the rebuilding of the ruined towns and villages of Belgium, France, Poland, and—shall we say?—Germany. The cost of living will be higher after the war, and as labor will be greatly in demand it will undoubtedly be an important factor in the situation. Not only this, but everyone will be looking for capital, and the rate of interest will be high.

The "Build-Now" policy, put into effect, will stir up business, release some of the money that is tied up, and ease the great pressure which otherwise will ensue upon the declaration of peace.

Yours very truly,

W. A. MOUNTSTEPHEN.

The Passing of a Type

HANDLING men, as opposed to driving them, is rapidly replacing the old-fashioned method of doing work. The bullying, blustering, foul-mouthed walking boss of but a few years ago is rapidly disappearing from construction work, and the quiet-spoken, tactful superintendent, quite frequently an engineer, is taking his place. The change marks the passing of a type, says The Engineering Record. The laborer of today is a different kind of man from the laborer of ten years ago; the increasing proportion of plant and mechanical equipment on construction work has brought about the change. The proportion of skilled workmen to the kind whose intelligence is equal only to the wielding of a pick and shovel and the use of a wheelbarrow has been greatly increased. The old type of workman expected browbeating and even brutality. But the new type resents it, even to the point of refusing to work. The thinking contractor realizes the change that has taken place and adapts his methods to suit. His aim is to get the maximum output from each man and, to accomplish it, he devotes his efforts toward developing a spirit of co-operation, of enthusiasm and of interest in the work.

Coleman Roads—Their History, Location and Construction

Specially contributed by H. T. Routly, D. L. S , A. M. Can. Soc. C. E.[*]

COLEMAN township was named in honor of Prof. A. P. Coleman, of Toronto University. It lies on the Temiskaming and Northern Ontario Railroad, three hundred and thirty miles north of Toronto. Within its boundaries are the famous Cobalt mines, which produce about seventeen million dollars' worth of silver and pay ten million dollars in dividends annually. It has been estimated by competent authorities that they have produced two tons of pure silver for every working day since they began to operate. The township has the highest assessed value of any township in the province with the exception of York. The bulk of its revenue is derived from its proportion (one-half) of the provincial tax of three per cent. of the profits of all mining companies in excess of ten thousand dollars per annum. Of Ontario municipalities the city of Toronto alone has a greater revenue from income tax. Its municipal organization is similar to that of other townships, but in the practical administration of its affairs it has attained a near approach to the commission basis. It was organized in April, 1906, with Mr. P. J. Finlan as Reeve, but on the incorporation of the town of Cobalt Mr. Finlan resigned to become its first Mayor, and Councilman Arthur Ferland was elected Reeve. Mr. Ferland has been Reeve by acclamation continuously since that time, there having been no municipal election in the township for eight years. The personnel of the Council has changed slightly, but two of the members have also served continuously since its incorporation. Mr. Ferland, who is a man of wealth and leisure, devotes a great deal of time to the township's affairs, occupying a position analagous to that of General Manager of a company—minus the salary.

Grade improvement on Haileybury road. Grade reduced from 18 per cent. to 6 per cent.

The township of Coleman is unique in other respects. In outline it is very irregular, owing to the prior location of the Temagami Forest Reserve and the Gillies Timber Berth. It has practically no agricultural lands, the mining areas being very rough and rocky, and the more level portions mostly swamp lands or sand plains. It has no fixed road allowances, but five per cent. of each lot is reserved for highway purposes, and the roads may be made wherever desired by the municipal authorities. Throughout the township road material in a natural state is exceedingly scarce, but this lack is compensated for by an almost unlimited supply of the finest trap-rock in the waste dumps of the various mines, and this trap-rock is most plentiful where mines are thickest and roads most required. In the early days, when rock containing under 40 ozs. (about twenty dollars' worth) of silver to the ton was considered "waste," some of the roads were built of this material which may eventually be recovered and run through the concentrating mills for the value it contains. Now all dumps containing 10 ozs. or over are reserved, and waste rock is not so plentiful, but in the meantime the roads have been built, so that it makes little difference.

To the highway engineer Coleman township is

Stone Culvert on Haileybury Road.

Lang St., Cobalt, from the Square. Macadamized by Coleman Tp. in 1911.

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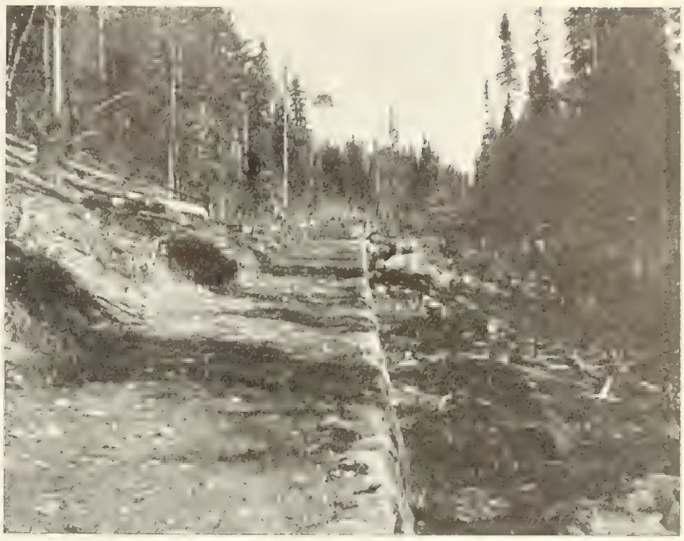
[*] Of Routly & Summers, engineers and contractors, Huntingdon, Que.

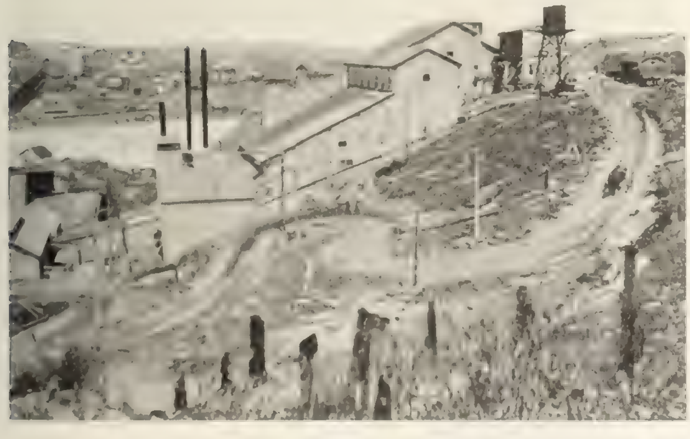
The Square, Cobalt. Laid with Rocmac in 1911.



Typical section on Latchford road, built with boulders on boulder bottom.

most interesting, as it offers unlimited difficulties in both location and construction. The writer, as Engineer and Superintendent of Construction from May, 1909, to July, 1913, had charge of all road work, and during this time practically all the roads were located and opened up, and the principal ones macadamized. During this period approximately one hundred and sixty thousand dollars was expended by the township on its own roads and on roads in the adjoining municipalities of Cobalt, Latchford, Bucke. Firstbrook, and Lorrain. The choice of location for the various roads was the most important and most difficult feature of the work. The general location was determined by the position of the various mines to be served, and these mines are located without regard to latitude, longitude, or altitude. Several of the main roads had been located and received considerable treatment in 1907 and 1908, and the foreman in charge followed the ridges, with their innumerable ups and downs, and avoided flat places or ravine bottoms. This was a costly error, and in many cases the roads had later to be rebuilt in order to secure uniform grades at permissible cost. No theoretical limits could be established for grade or curvature, but, having established the general location, each portion was so treated as to make the best of the possibilities, having due regard to cost and traffic requirements.

Immediately after assuming charge of the work the township was urged to purchase a road-building plant. For various reasons this was postponed until the second season, but the good results were so immediately apparent that the plant has been operated continuously each season since, and all the main roads in the township have now been macadamized. The principal streets in the town of Cobalt and a trunk road from Cobalt to Haileybury have also been constructed. Plans, profiles, and estimates were also prepared in 1912 for extending this road five miles further to the town of New Liskeard. The plant consists of a ten-ton Buffalo Pitts roller (a most excellent piece of machinery), a Champion portable rock crusher with bin and screens, sprinkler, dump wagons, etc. Note the entire absence of grader and scraper; these implements, so necessary in the ordinary road construction, were out of place in Coleman. The plant was always kept in thorough repair, and the best men available secured for its operation. During 1912 the roller was operated twelve hours a day, and part of the time seventeen hours. This was an exceedingly wet season; yet this roller operated one hundred and seventy-

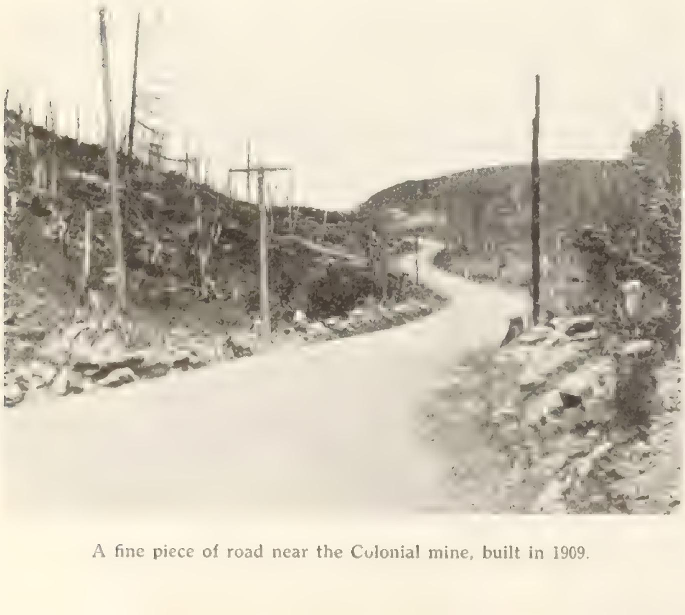


Switchback road located and built on their property by the McKinley-Darragh Mining Company.

The Coleman roller. Cobalt,Lake, shown in the picture, is now being dewatered to permit the mining of bottom.

Rock cut on Haileybury road.

five ten-hour days. Much of the work was on the heaviest grades, but the amount of coal used was only 347 lbs. for a ten-hour day. The original grates were in first-class condition at the end of the third season, as were also the cylinders and other working parts. The crusher was also subjected to very hard usage, as chunks of solid ore, steel bits of machine drills, sledge hammers, and such things, were quite common in all dumps, and often found their way to the crusher. As much as three wheelbarrow loads of such material has been picked out at a single set-up. In spite of this and the tough nature of the rock, the total cost of maintenance and repairs (including jaw and check plates) was only thirty per cent. of the original cost, including thorough overhauling at the end of the third season. It was driven by a 20 h.p. electric motor at a cost of from fifty to sixty dollars a month. This was made up by a flat charge of twenty dollars a month, three cents a kilowatt-hour for power used, and the cost of erecting and dismounting transformers and connecting wires. Prior to macadamizing, all revisions of alignment and other improvements to the subgrade were made, where possible, during the previous season. Of the original main roads of 1907 and 1908 several sections were re-located, and in many cases the ridges were abandoned and the roads laid in the ravines. In some cases the new road was placed just at the edge of the ravines, the outside being hand laid retaining wall high enough to form a shelf of sufficient width for a road with the least amount of material. Guard rails were at first vetoed by the Council, but were finally adopted. The posts were built into the wall during construction, and afterwards finished with two 2 x 6 railings. Many sections of road are along the sides of steep, rocky hills, and these dry rock walls are ten feet or twelve feet high. They are built for strength; the largest stones are used, and are not faced, but bedded. In a few instances the side hills on which they are constructed are so steep that a place for footings had to be blasted out, and in one instance a rock bolted concrete footing was necessary. On steep slopes retaining walls were necessary for economy of material, and strength was necessary to permit of rolling. The inferior walls built at first frequently had to be rebuilt before rolling was possible. The lines were given by erecting and bracing 1 x 5 templates every fifty feet on straight walls, and closer on curved walls. They were usually battered about three inches a foot, but this varied according to local conditions. The best walls were built at a cost of $1.50 to $1.65 a square yard for laying. This included hand-laying the backing to a total thickness of from two to five feet. Owing to the saving in the material, the fine and finished appearance was generally obtained at no extra expense over the cost of rough rock fill. Many of the ravines and other low sections which were avoided by the earlier locators proved excellent roadbeds, usually being underlaid by coarse open boulder formation, and readily drained. Some of them, however, were so deep and soft at first that horses could not be used, but when opened up they have supported stone roads under the heaviest traffic without settlement, although the vibration or tremor under traffic can be felt to a considerable distance.



A fine piece of road near the Colonial mine, built in 1909.

The difficulties did not cease with the location and construction of the subgrade. During macadamizing it was seldom possible to divert traffic, some of which was heavy hauling of ore, coal supplies and machinery, in addition to the more troublesome light fast driving. Trap rock does not re-cement or bind of itself, and no amount of rolling will consolidate it. Good lime rock of the two-inch size, can be rolled dry until it ceases to "weave," because it crushes and binds together. Granite will also become "sett" because of its gritty fracture. Trap rock will not crush together under the roller, and is of such fine grain and smooth fracture that even small sizes can be rolled on a solid foundation and will remain perfectly loose indefinitely and continue to weave or move during rolling. The ordinary macadam specifications are not applicable to this material. There is no lime stone in Coleman, and the cost of lime stone grit brought from the Southern Ontario quarries was prohibitive. In some parts of the township a cementing clay gravel was obtainable where mining companies had carried on deep surface trenching, and this was used with good results. The general method adopted, however, was to cover the top course of two-inch stone with an inch or so of screenings, and by continuous rolling and sprinkling wash this into the macadam, filling the interstices from the bottom upwards, always keeping a considerable quantity of screenings on the surface to protect the top layer of stone from being ground by the excessive rolling. The upward progress of the filling action was indicated by the water. For some time this would run through the road instantly, no matter how fast it was applied, but as the lower portion became filled and consolidated less water was required, and by digging into the road with the heel the water level and stage of construction could be determined readily. The top stones remained perfectly loose until the filling action caught them from below. Presently the water, instead of rushing down through the road, began to flood off to the sides, the surface became filled and "set," and the road was bound. No wave of mud or slurry was ever obtainable. Trap rock will not produce mud unless ground exceedingly fine, and hence these roads are perfectly clean and free from mud in wet weather. The wearing surface consists of 1 in. to 2 ins. of screenings, which on this impervious foundation can be bound hard and smooth, resembling sheet asphalt, but not slippery. In wet weather this surface is clean, producing no mud, but on hot dry days it disintegrates and rapidly blows away, producing considerable dust. The cost of macadamizing after the preparation of the subgrade ran between eighteen hundred and two thousand dollars a mile. As so much of the township has been entirely denuded of trees, and as the roads are usually elevated above adjoining lands, the sun and wind have maximum effect. In addition to this, motor buses and cars were found destructive, and to meet these conditions many experiments were tried with various kinds of road oils. Nothing gave satisfactory results until Tarvia "B" was tried. The first tank car was purchased and applied in June, 1913. The writer severed his connection with the township shortly after, but recommended the continuation of Tarvia treatment, and during the seasons of 1913 and 1914 the sum of $7,116.32 was expended in applying 33,349 gallons to 14.35 miles of road, or at the rate of about $500 for 2,400 gals. a mile. The quantity is about right, but the cost should not have exceeded $400 a mile.

Road around Kerr Lake.

Another patent road binder used was Rocmac. In June, 1911, 990 square yards of this was laid on Cobalt Square—"the busiest spot in New Ontario"—at a cost of 93 cents a square yard. Although subjected to severe flooding during several big fires, it has proved very satisfactory, being at its best where the traffic is the heaviest.

Wages varied from $2 for laborers, $2.50 for foremen, and $5 for teams, in 1909 to $2.25 for laborers, $4 for foremen, and $6 for teams, in 1913. Dynamite was in almost daily use by nearly all the gangs, but no serious accident occurred to either persons or property. Several hundred cubic yards of rock were taken out in the Cobalt streets, and in the township we were always close to electric transmission lines, telephone lines, compressed air pipe lines, or other unprotected structures. This immunity from accidents was due to the employment of skilled workmen, to careful supervision, and to the fact that the foremen and men were constantly reminded that the township was willing if necessary to pay a little more a cubic yard, but that they wanted no accidents, and that carelessness meant dismissal. It is most difficult, however, to get capable, experienced rock men to take reasonable precautions for the safety of themselves and their fellow workmen, and a large proportion of the accidents that occur with explosives are due solely to the deplorable recklessness of the workmen themselves.

The results obtained locally by the use of Coleman trap rocks as road material have attracted much attention, and many have investigated the feasibility of supplying this material to Southern Ontario municipalities. In 1912 a trial shipment of twenty carloads was made to Toronto, part being used on the Kennedy Road, near Scarboro, and the balance on Dundas Street in the city. At the latter place a short but strenuous "stampede" was engineered by an ex-Cobalt prospector, who "salted" the rock piles on the street with rich silver speciments from his cabinet and allowed himself to be discovered finding them. Much of the rock contained showings of pyrites, white iron, or smaltite, and some "rich stakes" were carried off by the lucky first locators.

Concrete Blocks on the Original Panama Canal Contract

CONCRETE blocks made by the French Canal Company in 1886 have been used extensively in beach protection, and their use appears to be well warranted by the endurance of the material. Although the concrete was formed in blocks like cut stone, and not made monolithic as in all recent works, its endurance under severe weather conditions is remarkable. The materials used were Portland cement, Bohio rock, and Panama beach sand. In quoting the specification under which this concrete was made, Col. Goethals says:—

> "The Bohio rock is volcanic agglomerate of rather low specific gravity and medium hardness, but very resistant to atmospheric weathering. During severe "northers," the breakers have sometimes been strong enough to roll the blocks upon the beach."

The French records of the contract of 1886, under which these blocks were made, contain the following specifications:

> "Stone to pass through a ring 0.06 m. (2.36 in.) diameter, and to be washed and screened to eliminate all particles smaller than 0.02 m. (.78 in.) diameter. The cement mortar to be composed of 800 kilogrammes of cement mortar to 1 cu. meter of sand. These materials to be mixed dry upon a wooden platform under a roof, and water to be added by means of sprinkling hose, taking care to use only as much water as may be necessary to produce a homogeneous mortar which will stick to the shovel. The concrete to be composed of 2 parts of mortar and 3 of stone. After the mortar shall have been mixed as specified above, add the stone, and mix with an iron hoe, until all of the stone shall be completely covered with mortar; the mixing to be accomplished without further addition of water; the stone, however, to be watered carefully in the pile, at least one hour before using."

Dust Prevention: Method of Application and Use of the Various Oils

THE method of application and the amount of oil that should be applied will depend upon the kind of oil used, the condition of the surface of the road on which it is to be used, and other local conditions. The light oils should be applied more frequently and in smaller quantities than the heavy oils. The crude or the refined oil may be applied either cold or hot, according to its quality. Most crude oils, and some refined oils, have been applied cold; but it is necessary to heat the heavier oils before they are applied.

The oil is shipped either in barrels containing from about 30 to 50 gals. each, or in steel tank cars containing from 6,000 to 10,000 gals. each. If a heavy oil is used, it is necessary that the tank car be equipped with steam coils in order to heat the oil, that it may be drawn or pumped from the tank.

When the material is shipped in barrels it is customary to heat it on the roadside in heating kettles holding from 4 to 10 bbls., from which it is applied to the road surface by the use of hand pouring pots of about 4 gals. capacity. It is important that these pots be provided with spouts that will spread the oil in such a way as to produce an even distribution, as in this lies the secret of the success of its application. The ordinary water sprinkling spout with the holes punched larger with an 8 d. or 20 d. wire nail, depending upon the grade of material being used, will usually give very satisfactory results.

When the oil is shipped in tank cars, it is usually applied to the road from tank wagons, holding from 400 to 800 gals. Tank wagons used for this purpose may be classified under two heads: (1) Gravity tanks, which allow the oil to flow by gravity through a perforated pipe, which sprinkles the oil onto the road. (2) Pressure tanks, which spray the oil under pressure onto the road through perforated pipes, or a series of nozzles, or a single large hose and nozzle. The pressure is produced either by steam or compressed air in the tank itself, or by pressure in the distributing pipes only, induced by some form of pump.

When the oil is applied to the road surface in the form of a fine spray, which can be done with the pressure tank wagon, a more even distribution and better penetration is secured. The pressure tank wagon is particularly valuable when it is desired to use a very light application of oil. By the use of such a wagon, so light an application as ⅛ gal. per square yard can be evenly spread, while about 1-3 gal. per square yard is as small a quantity as can be uniformly distributed with a gravity tank. The use of the pressure tank has an additional advantage; when the oil under pressure comes into contact with the stone with some force, it blows the dust from the surface, and thus by cleaning the stone secures a better adhesion of the oil. This is very beneficial with the heavier asphaltic oils where it is absolutely essential that the surface of the large stones be exposed and clean in order to insure a good bond. However, if the oils are not too heavy, and the road is gone over several times with the gravity tank and a very light application given each time, a very even distribution can be secured and fairly good results obtained. The tank wagon is sometimes provided with a heating arrangement either in the form of a fire box underneath, or in the form of steam coils to be attached to the roller boiler. With such an equipped tank, the heavier grades of materials may be applied.

In general, it is better to give the middle of the road a heavier application than the sides. This is especially true in the case of the lighter oils and emulsions, and calcium chloride solution, owing to the tendency of these materials to being carried to the sides of the road by gravitation and running water. While in the case of the lighter oils, no cover is necessary after the oil is applied, yet better results are usually secured by covering the oil with a layer of coarse sand. When the heavier oils that require heating are used, it is essential that they be covered with either screenings or coarse sand. Stone, slag or gravel screenings are best suited for this purpose. The screenings should be dry and clean and free from dust, and of a fairly hard material. A size that will pass a ½-in. circular mesh and be retained on a ¼-in. mesh is usually very satisfactory. A size that will pass a ¾-in. screen and even a 1-in. screen is sometimes used with perfect satisfaction. The heavier the grade of oil that is being used, th coarser the screenings may be. If the surface is afterwards rolled, larger screenings can be used than where traffic alone compacts them. Unless a heavy oil that stiffens quickly upon exposure to the air is being used, it is best to allow the oil from 5 to 36 hours' time to be absorbed by the road surface before applying the screenings. It often happens, however, that the road cannot be closed to traffic so long, in which case the screenings are put on immediately after the oil is applied, with very good results. If the oil stands in little pools on the surface after it is applied, it should be gone over with hand brooms and the puddles of oil broomed evenly over the surface before the screenings are spread. This will aid in producing a more uniform surface, and uniformity of surface is not only one of the essentials in buiding a road, but it is also one of the essentials in maintaining a road.

Dust prevention is so closely associated with road preservation that the two should usually be considered together, for any method of preserving the surface will invariably reduce the dust. It might be well to state, however, that such surface treatments of oil do not constitute the building of a road. At its best, it constitutes merely a maintenance proposition. It is a false notion to hold that an old worn-out, rough road surface can be made good by the application of a little oil. In order to maintain a good surface, it is essential that the surface be put in a good condition previous to the application of the oil. Therefore, unless it is merely intended to temporarily allay the dust, the holes and ruts should be eliminated from the surface before any oil is applied. The depressions in the road should be cleaned of all dirt and foreign material, the edges cut vertical and the bottoms loosened by picking. The depressions should then be filled with stone, slag or gravel of the same quality and size as the remainder of the road surface, and this material thoroughly compacted by hand ramming or rolling.

Poor results in the use of oil treatments frequently come from the fact that the surface had not been previously cleaned in a proper manner. The practice of some small villages of putting oil on a road surface already covered with several inches of dust and filth, cannot be too severely condemned. When such practice is followed, the street, after every rain, will be covered with a black, oily mud, which may be as objectionable as the dust itself. Before the lighter oils, such as are put on cold, are applied, the surface shuold be comparatively free of all loose dust and foreign material. Before the heavier materials, such as require heating, are applied, it is very important that the surface be cleaned of all matted dirt, dust and foreign material, so as to expose the large stones in the surface of the road. If possible, the surface should be swept with horse sweepers, and afterwards with hand brooms so as to remove the dust from between the stones to a depth of from ¼-in. to ¾-in. The heavier the grade of oil used, the more important it is to have a clean surface on which to apply it. The surface should be dry and the warmer the air temperature the better.

There has been considerable discussion during the past year concerning sprinkling of the stone with water before applying the bitumen, this information is likely to be misleading; for it is believed that it is not the presence of water that might cause the better results, but the effect the water has in cleaning the dust from the stone which gives a better adhesion of the oil. Hence, we would conclude that if sprinkling with water before applying the oil is done, it should be on only hot, dry days,, and then sufficient time given after the sprinkling for the water practically all to evaporate before the oil is applied. Therefore we are still warranted in saying that bitumens should be applied only to dry, warm surfaces. During June, July and August is the best time of the year to apply such materials to the road surface.

The amount of oil that should be applied to the road at any one time will depend upon the condition of the road surface, the quality of the oil used, and the nature of the traffic. In general, it may be said that a couple of light applications during the year will give better results that a single heavy application for the same amount of oil. For the lighter oils, on a comparatively smooth surface, an application of not to exceed ⅛ gal. per square yard may be all that should be applied at one time, while on a rough, pitted surface with the binder swept from the top surface of the road to a depth of from ¼-in. to ¾-in., as much as ¾ gal. per square yard of the heavier oils might give more satisfactory results. Precaution should be taken, however, that there is not an excess of oil applied, as too heavy a coat of the lighter oils is objectionable because of the formation of a black, frothy mud after a rain, while an excess of the heavier oils will form a thick mat on the surface which will be peeled and picked up by the horse-drawn traffic. The heavier the automobile traffic, the greater the amount of oil that can be applied up to a certain limit. The aim should be to put on just sufficient oil (and screenings) to form a thin mat over the surface of the road. This mat should not be of any appreciable depth over the surface of the larger stones, but sufficient to well seal up the voids between them. This will hold the binder in the stones and make the road surface water tight.

The cost of oils varies according to the quality of the oil. Also the price of the same oil fluctuates from time to time. The cost of applying the cold oil varies from ½c. to 1c. per gallon, while the cost of applying the hot oil will vary from 1½c. to 3c. per gallon.

The preceding information is abstracted by Engineering and Contracting from a bulletin on Dust Prevention, issued by the Highway Department, State of Ohio.

Corrosion of Iron and Steel Water Mains

IN a paper on this subject read by Mr. W. J. E. Binnie at a meeting of the Institution of Sanitary Engineers (London), the author said that internal corrosion and incrustation of the pipes caused a material reduction in their carrying capacity. This had to be allowed for by designing the pipes of such diameter that they would still be able to pass the required quantity of water, even after incrustation had taken place. Although incrustation could be removed by mechanical means, the protective coating could not be restored, and once scraped, the pipe deteriorated rapidly, required frequent rescraping, and presented fresh surface for attack, with ultimate reduction in the strength of the pipe. The economic bearing of corrosion was even more important in the case of steel than of iron, as, owing to the smaller thickness of the pipe, the loss by corrosion represented a much larger percentage loss of strength.

It has long been known that for the corrosion of iron, water and oxygen are required, and, according to the older chemical theory, the presence of an acid is also necessary. This is usually found in the carbon dioxide present in the air and water. According to this theory, this carbon dioxide combines with the iron to form soluble ferrous carbonate or ferrous hydrogen carbonate. The oxygen of the dissolved air then converts the soluble iron salt into ferric hydroxide, which is deposited as rust and liberates carbon dioxide, which is free again to attack the iron; and so the process is repeated until protection may be found by the deposition of rust on the iron. It appeared from later experiments that acid was not necessary if dissolved oxygen were present in the water, and an electrolytic theory was put forward. According to this, the water contains free positively charged hydrogen ions. The hydrogen ions tend to combine with the dissolved oxygen, but cannot do so until they obtain a negative charge. This they obtain from the iron which is changed into the ionic state, combining with the hydroxyl ions to form ferric hydroxide or rust. According to some experimental evidence, however, corrosion does not take place when all traces of CO_2 are removed, even if dissolved oxygen be present. The matter is a controversial one, but the author declared that the balance of opinion was in favor of the electrolytic theory. A biological theory has also been put forward, attributing corrosion to the action of organisms; but, as corrosion takes place under conditions that inhibit life, this explanation is improbable; although it is possible that the acid secretions of organisms in the water may accelerate corrosion in some cases.

Internal corrosion of water mains is accompanied by the deposition of incrustations of a limpet-like form, the upstream face of the limpet being steeper than the downstream face. They rarely form to a greater height than 1½ in. in large mains. They are hard without and soft within, and are composed of concentric layers of ferric oxide, the outer layers being sometimes black magnetic oxide. The iron below the limpets is invariably pitted by corrosion. Whether the electrolytic or the acid theory be correct, the presence of dissolved oxygen in the water is essential before corrosion takes place. The question naturally presents itself whether comparative immunity from attacks could be brought about by the partial removal of the dissolved oxygen from the water. In the case of a 350-mile 30-in. main between Mundaring and Kalgoorlie, Western Australia, such a course was suggested on the occurrence of severe corrosion, but was not put into practice. The idea was to remove the air by spraying in a vacuum.

As might be expected, the corrosion increases with the rapidity of flow of the water; but there appears to be a critical velocity above which the corrosion ceases to rise, and even diminishes again. Sewage contamination appears to use up the free oxygen, and, provided there is no deterious acid present, such water does not corrode the pipes to any great extent. Grease also acts as a protective. Hard waters, such as London water, are only slightly corrosive. The addition of alkaline solutions greatly diminishes corrosion. External corrosion of pipes is much increased by the presence of sea-water, and contact with ashes and cinders has a deleterious effect, probably due to galvanic action. It is generally agreed that cast iron resists corrosion better than steel, and that this is largely due to the siliceous foundry skin affording a certain measure of protection.

Experiments show that, speaking generally, the harder the steel the less liable it is to corrode. Hard steel, however, cannot be used for welded pipes. Small percentages of chromium and copper are of value in reducing corrosion; but it is important to specify a low manganese content, as manganese generally indicates the presence of manganese sulphide, which increases the liability to corrosion. Nickel is a valuable adjunct in reducing corrosion, but is only really effective in large quantities, which renders the steel unsuitable for pipes. Provided that phosphorus is limited to 1 per cent., its presence is rather beneficial than otherwise. Silicon has a marked preventive action; if there be 20 per cent. present, the product is practically incorrodible, whilst 3 per cent. has a marked beneficial effect. Unfortunately, such high percentages render the metal unsuitable for pipes, owing to its excessive hardness and brittleness. The presence of sulphur is always objectionable, as it not only tends to set up galvanic action, but forms sulphuric acid in addition. Steel which has been subjected to stress is more liable to corrode than unstressed metal. It is, therefore, important to remove the internal stress by annealing.

In the early days of electric traction considerable damage was brought about by stray currents; but recent Board of Trade regulations afford quite sufficient protection to water-mains, provided they be kept at least 2 ft. clear of the rails, and that the ground be not impregnated with salt water, in which case it is well to surround the pipes with lime concrete as an additional protection beyond the usual coating mixtures. Abroad, it is well to give the rails a wide berth, unless the regulations afford protection equivalent to that given by the Board of Trade.

For ordinary cases, it has been found that a coating of Dr. Angus Smith's solution is a fairly efficient protection against corrosion. The mixture used nowadays consists essentially of coal-tar and pitch-oil in the proportion of 2 to 1 by bulk, and the pipes are dipped in this at nearly boiling temperature after all rust and scale have been removed. There is a possibility that pinhole penetrations caused by air bubbles will impair the coating, and a second dipping is advisable. In the case of an important pipe line at Birkenhead an entire recoating of the inside of the pipes with Siderosthen, an oil-tar mixture, is specified. For outside protection a wrapping of hessian saturated with bitumen is usual. The wrapping on the joints and on places where the hessian has been damaged in transit has to be done in the field.

Although Chlorinated, B. Coli Increase in Number

MULTIPLICATION of B. Coli in bleach treated waters in summer has been noted by H. E. Jordan, chemist for the Indianapolis Water Company, in a recent paper presented to the Indiana Sanitary and Water Supply Association. Mr. Jordan was controverting a statement which appears in the report of the experts promulgating a standard of purity for interstate carriers. Of 201 samples, 21 gave positive B. Coli reactions immediately after treatment, 39 after 24 hours standing and 42 after 48 hours. The increases were confined to the warm months. From November to April actual decreases were noted. These studies are now being carried out in greater detail to obtain all possible information as to the ability of a bleach-treated filtered surface supply to meet the standards after various lengths of exposure to various temperatures.

There still remains a tendency among filter men to avoid giving out definite information on their B. Coli findings, which indicates, said Mr. Jordan, a mistaken idea that these bacteria are necessarily a bad indication or at least that a statement of such findings will be the basis for criticism. He gave, however, results from four plants. For nine years, Washington, D.C., operating with a raw water carrying B. Coli 18 per cent. of the time, has reduced the presence of the organism in 1-cu. cm. samples to 0.8 per cent. of the time. At Indianapolis, for eight years B. Coli were present in the raw water 48 per cent. of the time and in the effluent 3.1 per cent. Lawrence raw water carries the germ in large numbers at practically all times. Its filtered water samples for 17 years have contained B. Coli 10.8 per cent. of the time, ranging as high as 18 per cent. for three years. At Harrisburg the raw water is rarely free but the average percentage of time during eight years when B. Coli were present in the effluent was 1.1. In these cities water has been eliminated as a factor in typhoid fever causation. Data from Pittsburgh and Albany are too meagre for tabulation but show that these plants do not continuously attain the carriers' standard. However, both plants have effected marked and continued reduction in typhoid death rates.

Mr. Jordan concluded that while the standards are not intended for public water supplies, their operation necessitates their conforming to it; that the assumption of non-multiplication of B. Coli is not beyond dispute, and that public water supplies are being safely used which do not continuously meet the standards.

Erratum.—In the publication of the article, "The Design and Construction of Buildings for Industrial Purposes," which appeared in our last issue, the credit was inadvertently omitted. The article was an extensive abstract of a paper read before the Royal Institute of British Architects (London, Eng.) by Mr. Segar Owen.

Features of Park Improvement Work[*]

The More Important Problems Involved in Construction and Design—Organization of Department—Drainage—Grading—Paths—Requirements for Site

THE working organization of a park department generally comprises a counsel; landscape architect, who recommends as to location and prepares grading and planting plans and outline of general features; purchasing department, to secure real estate; an architect who designs buildings, gateways and other structures; a superintendent's department, which succeeds the engineering department and attends to gardening and planting operations and ultimate maintenance of the parks; clerical force; a secretary and treasurer of the commission; a title guarantee department or company to pass on property transactions; engineering department, consisting of chief engineer, assistant engineers, instrument men, chainmen, rodmen, inspectors, and a chief gardener and his assistants. During construction work the park is in charge of the engineering department, including any police assigned to it, after which control passes to the superintendent's department.

The work of the engineering department comprises: (a) Property surveys of lands to be acquired, with the deeds, and preparation of property descriptions to be incorporated in deeds of conveyance. (b) Topographical surveys for use of landscape architect. (c) Designs of sewerage, drainage, water supply and lighting systems and of all engineering features of walls and bridges. (d) Preparation, letting and supervision of all contracts for construction work. (e) Planting and gardening operations. (f) Maintenance of completed work until it is turned over to the superintendent's department, which may not be organized until the work is well under way or even completed. (g) Policing of all acquired areas.

General Requirements for Park Lands.—This is specifically a question of landscape architecture and common sense. The leading requirements are: (1) Parks must be accessible. City parks should be so placed that all of the population can easily reach at least one park on foot. The largest country parks should be easily reached by carriage, automobile and trolley car with reasonable fares.

(2) The park system should be a connected system, the various parks being joined by parkways or boulevards. This is a verry essential matter.

(3) A park should be located with regard to the other requirements of the territory in which it is placed. Central Park, New York City, although an asset of inestimable value, is so placed that it cuts off two of the main arteries of travel running north and south on Manhattan Island.

(4) Parks should be planned with a distinct view of the population to be benefited, the problem being worked out for each individual case. The interest of all should be considered alike—drives for the rich and resting places and playgrounds for the poor.

(5) It is a fact well known to experts that poor lands from the viewpoint of the real estate operator are often the best for park development. Low and swampy lands which are usually festering spots in cities are among this class. As an illustration, Tacony, Pennypack and Cobbs creek valleys, in Philadelphia, are narrow and deep, and if laid out in city blocks the grades of the cross streets would be very steep. Moreover, an enormous amount of filling would be required for the street construction. These valleys were bought by the city for park purposes at a price less than the cost of such street filling.

Draining.—Underdraining swampy or wet soils can be accomplished by laying agricultural tile or by stone or brush ditches. In the former, horse shoe tile laid on one-inch boards or two-foot collars of cylindrical porous clay pipe with four-inch collars or rings for the joints may be used. Two-inch, three-inch and four-inch pipe are the sizes ordinarily used. They are laid in parallel ditches joining the main at an angle of 45 degrees by Y connections. The distance apart of the trenches, their depth and the size of the tile can be determined by experience; the nature of the soil, slope of land and elevation of water table are determining conditions. If the drains discharge into an open channel, the tile should be protected from injury in some way. A 12-foot length of cast iron pipe is recommended, a "second" being suitable for this purpose.

In making stone or brush ditches, stones or poles are placed in the bottom of the trench, leaving open spaces for the passage of water. To prevent clogging with earth they are covered with branches or straw, on which the backfilling is deposited.

Park sewers are used for removing surface water and also for removing the sewage from any buildings upon the ground. The latter are generally connected with the city sewerage system or a small disposal plant. The storm sewers discharge into the nearest available outlet.

The sewers are generally laid under the sod rather than roads or walks, and in shallow trenches; and it will usually be better to occasionally dig up the sewer to remove an obstruction than to provide manholes at every change of line and grade, as in the case of city sewers.

The surface water inlet is generally merely an iron grating set in concrete over a 6-inch elbow, from which the water is carried to a catch basin or directly into the sewer. Similar gratings are placed on top of the catch basins. A catch basin may be placed on one side of a road or path and a plain inlet on the other side connected with it. The inlet grating is generally rectangular for paved gutters and circular for grass gutters or low spots in lawns.

Surface water inlets should be placed at frequent intervals, the spacing often used being 125 feet.

Grading.—Modern practice places gutters for collecting and removing surface water in the sod at one side of the drive or path rather than at the edge of the paved path thereof. These swales are usually depressions 4 to 6 inches deep and 6 to 12 feet wide running parallel with the drives and paths, their cross section showing a continuation of the line of the adjacent slopes. They are sodded and possess the advantages of intercepting storm water and preventing deposits in the sewers. Where a steep slope comes down close to the drive or path, these swales cannot, of course, be used, and cobble or stone gutters may be necessary.

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[*] From lectures prepared by William T. Lyle, Professor of Municipal Engineering at Lafayette College.

No fields or lawns should be made absolutely level, but slight slopes or depressions should be provided to remove the surface water.

Lakes and ponds should be at least 8 feet deep if possible, to prevent objectionable growths of water plants; but it is safe and proper to provide a shelf along the shore line extending out 8 to 10 feet with a drop of about 18 inches.

In constructing artificial lakes, it sometimes happens that a part of the shore lies in an unstable soil which cannot be excavated without flowing. To construct a firm and stable shore the following method has been used: A single line of piles is driven close along the shore line but with every fifth one omitted. At these gaps batter piles are driven at as great an angle with the vertical as possible, which angle can seldom be made greater than about 20 degrees if a drop hammer pile driver is used. The piles are all sawed off about 1½ to 2 feet below the proposed water surface, and a wale is framed into them in such a way that the thrust of the batter pile is transmitted to the wale and thus against the vertical piles. Bolts with washers are used to draw each pile close to the wale, which consists of 8 by 10-inch timber. The piles are notched to receive it so that the bolts shall not be obliged to take up much of the thrust. The material on the water side of the piles can be removed to the depth of the lake. Good upland soil is then dumped in over the piles to reinforce them and provide a firm shore. This soil will, of course, sink down into the soft material below and more will have to be added from time to time, until all settlement ceases. It is wise to fill in considerably above the proposed grade, and then, after say a month, remove the surplus material.

Paths.—All paths should be on an incline to provide drainage, and provision made at the low points for removing water by carrying a tile to the nearest catch basin or sewer or to a gutter or swale. Cinder or broken stone foundation is laid under the surface material of the path. These precautions are, of course, unnecessary in dry soils, and the cinder foundation is unnecessary in gravelly ones.

If paths are desired curved in their lines, these curves should not be laid out arbitrarily but should have some reason, such as the avoiding of trees, rocks or hillocks, etc. If natural obstacles do not exist, they can sometimes be introduced in the design.

In order to increase the effective width of a park walk, wings of gravel 4 feet wide on each side are often used. These wings should have the full cinder foundation.

Paths should be crowned in the middle. A crown of three-quarters of an inch in a walk 8 feet wide is ample for cement, while for gravel walks it should be (say) 50 per cent. greater. For gravel walks, hard rounded gravel with cementitious properties is desirable.

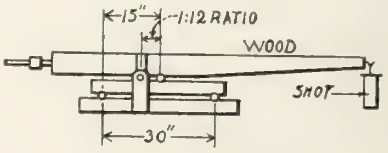
Construction.—In beginning the construction of a park, the underdrainage should be laid first. Following this, the first thing to be done is to remove all the top soil and pile it in large mounds to be used for dressing the land after the grading is completed.

Grade stakes are set, marked on the side with the proper cut or fill, measured from the top of the stake; or driven with their tops at grade, if possible, in which case the top of the stake is marked with crayon. For heavy fills long poles may be used with their tops at finished grade. Where the cuts are considerable a second set of grade stakes must generally be set after the first are dug up. To preserve the latter on mounds of undisturbed ground is expensive, and they are apt to be disturbed.

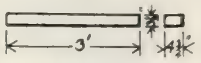
Simple Concrete Tester

FIELD tests to determine the strength of concrete can be made by means of a simple apparatus like that illustrated in the drawing herewith, which was developed in connection with work on the new Welland Ship Canal, says Cement World. The machine, while not absolutely precise, is sufficiently accurate in its determinations to serve all ordinary practical purposes.

The test pieces are made from concrete taken directly from the mixer, and are molded, as shown in the drawing, to a size 3½ by 4¾ in. in cross-section and 3 ft. long, without reinforcement. After being stored for definite periods under known conditions, they are tested to breaking under bending stress, by means of the leverage device indicated. The ratio of weight arm to power arm is 1:12. Shot of uniform size is poured into the bucket at the end of the lever; and a gauge which measures directly only the depth of the shot, is scaled to indicate in pounds per square inch the bending stress exerted on the test piece. With the exception of the steel pins and fulcrum, the apparatus is made entirely of wood.



CONCRETE TESTER



SHAPE OF TEST PIECE

Causes of Concrete Road Failures

OPERATIVE causes actually found to account for the poor results sometimes observed in concrete road construction are listed as below in a pamphlet, "Concrete Pavements in Western Washington," recently published by Reitze, Storey & Duffy, Inc., of Seattle, Wash. They are all traceable to mistakes in judgment, to ignorance, and to lack of study of the correct methods to be followed.

1. No rolling of subgrades, even on fills up to 20 ft. in depth.
2. No wetting of subgrade immediately preceding placing of concrete on the hottest of days.
3. The use of unseparated and unwashed aggregates, more commonly called "pit-run" material, used in proportion of the sum of two aggregates when separated.
4. The most careless handling and protection of the aggregates until such time as they are mixed with the cement; "I have seen aggregates piled alongside the road, so dust-covered and so thoroughly mixed with dirt from teams driving over them that at first glance one would think these piles of aggregate were simply dirt excavated from the subgrade."
5. Dirty and unclean water used.
6. The concrete poorly and carelessly mixed, handled, and placed.
7. The concrete burned and dried too quickly by reason of no covering and lack of wetting down and keeping wet after placing.

Testing and Handling Concrete Aggregates[*]

By H. S. Mattimore[†]

FOR highway paving, the selection of good materials and a first-class quality of engineering have given New York State an excellent quality of concrete. While the cement used, of course, must be of good quality, the same is equally true of the other ingredients.

Sand and Screenings

To insure a high grade of fine aggregate, the following specifications have been drawn up by the State Highway Commission:

"Fine aggregate shall consist of sand, free from organic matter; that which shows a coating on the grains shall not be used until satisfactorily washed."

"No. 1 sand for use in concrete pavements shall be of the following gradation: 100 per cent. shall pass a ¼-inch screen; not more than 20 per cent. shall pass a No. 50 sieve; and not more than 6 per cent. shall pass a No. 100 sieve."

"Sand may be rejected for this class if it contains more than 5 per cent. of loam and silt."

"Mortar in the proportion of 1 part cement to 3 parts of the sand to be tested, shall develop a compressive strength at least equal to the strength of a similar mortar of the same age composed of the same cement and standard Ottawa sand."

"Screenings when approved in writing by the Chief Engineer, may be substituted for a portion of No. 1, 2, and 3 sand under the following conditions:—The screenings shall be free from dust coating and other dirt; 100 per cent. shall pass a ¼-in. screen; and not more than 6 per cent. shall pass a No. 100 sieve." "The compressive strength of a mortar, in which the screenings and sand are in the proportions intended for use, shall be at least equal to the standard strength obtained with sand of the given class."

You will notice that the only allowable use for stone screenings as fine aggregate, is when they are mixed with a proportion of sand. We have had some field tests made in using all screenings for aggregate, and these have shown such doubtful results that it was not thought advisable to replace all of the sand by screenings. It is possible to get good concrete with screenings in laboratory tests; but when tried on a large scale in the field, it is extremely difficult to get a uniform, well-graded material. The proper proportion of screenings from the hard variety of stone will improve a fine-grained sand, but the high costs for careful inspection and proper mixing are likely to make their use prohibitive, except in instances where a good quality of sand is very expensive.

Stone and Gravel

The specification for stone as coarse aggregate in concrete, requires that samples shall be tested before being used in the work. It must be free from dirt and coating of any kind. As a tentative specification we require that stone for use in concrete pavement shall show a "French coefficient" of at least 9 when tested in the standard abrasion apparatus for stone.

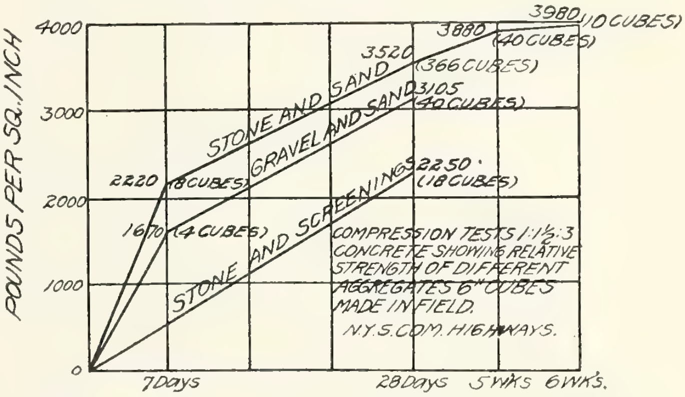
Some few miles of concrete pavement have been built with gravel used as coarse aggregate. These were in sections where a very high grade was available. Such material was all tested and had to meet the requirements of being all composed of sound durable stone, and to be absolutely clean and free from coating. We have found the gravel banks in a large part of the State to run so non-uniform that it was not thought advisable to use this product in concrete pavements, except in limited areas where we have assured ourselves from past experiences that a uniform product can be obtained.

During the routine of the physical laboratory within the past year, the work included the examination and testing of samples representing 1,080,580 barrels of cement, 909 samples of sand and 857 samples of stone. The cements were tested according to the standard methods of the "American Society for Testing Materials." There being no standard tests for sands, the following is a brief outline of the tests and methods employed in our laboratory.

Sand Tests

Gradation.—1,000 grams of the sand to be tested, after a careful weighing, is screened through the ¼-in. No. 6, No. 20, No. 50, No. 100, and No. 200 mesh sieves. After weighing the residue on these sieves, the proportions passing are readily computed. We found from past experience that these are the essential sieves for an intelligent judgment of the gradation.

Voids.—For the determination of the voids, the sand is placed and loosely compacted into a graduated cylinder. This latter has a hole drilled in the bottom, in which a tube is connected leading from a burette filled with water. This apparatus is placed and worked so that gravity causes the water to rise slowly through the sand, forcing the air ahead. By reading from the burette the amount of water which has flowed out, the voids can be computed within a practical degree of accuracy. This method of allowing the water to flow in from the bottom rather than from the top of the sand, eliminates the forming of air pockets, which are extremely difficult to avoid by the latter method.



Curves showing relative compressive strength of 1:1½:3 concrete made from different aggregates. These cubes were all made in the field and stored in field 21 days.

Loam.—For the determination of the amount of loam, a portion of the sand sample is placed in a graduated cylinder, and well covered with water. This is thoroughly agitated, and then allowed to settle from 10 to 24 hours. The loam and silt, which readily separates from the sand, is deposited on top of the sand, and the proportions can easily be computed. This method of loam determination by volume, we believe, is as refined a determination as necessary to fit all practical requirements. It also allows an easy method of checking in the field.

Compression Tests.—The majority of our compression tests are made on 3-in. cubes mixed 1 part cement to 3 parts sand. These are stored in moist air, and broken in 14 days. Four cubes are made from each sand 2 from the natural product, and 2 from the washed. For a comparison of the compression, four cubes of the same size, mixed with standard Ottawa sand and the same cement, are made, stored, and broken under the same conditions and at the same age. The cement used for this purpose is a blend mixed in the laboratory from cements which show similar characteristics under tests. The cement and sand in the cubes are proportioned by volume rather than weight, to avoid the variation of the latter in sands of different character. The cement, although measured by volume, is carefully checked by weight, to eliminate different degrees of compactness in measuring.

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[*] Paper presented to the Association of American Portland Cement Manufacturers.

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At present time we are running a series of sand compressions on both 2-in. and 3-in. cubes, for the ultimate purpose of using the smaller size cube. These latter will be made up in lots of four, two of which will be broken at 7 days and two at 28 days. This in many cases will decrease the time necessary for a sand test, and also enables us to observe the relations of the strengths at the different ages.

Of our tests we consider the compression strength of the sand in mortar of major importance; but, as this depends more or less on other determinations—especially gradation and percentage of loam, silt, or organic matter—it is advisable to run a full test in order properly to judge the material.

Occasionally sands are tested for tensile strength; but our experience on the realtion between tension and compression strengths of sand mortars has verified the results obtained by other investigators in the fact that this relationship is so non-uniform that it is absolutely unreliable; and, as we build plain concrete to withstand compression rather than tension, we should test it from that standpoint.

During the course of construction, the concrete highways are under constant supervision of competent engineers. The duties of these men not only include ordinary highway engineering work, but they are required to inspect closely all concrete aggregates. This especially refers to sand and gravel supplies; and when such material shows any great change in character, this being determined by field tests for gradation and loam, such conditions are immediately reported to their superior engineer, who takes steps to rectify them and compel the contractor to secure suitable material.

One of the important checks instituted within the past year on our concrete work was in the testing of the finished product. Engineers in charge of concrete work are required to make 6-in. cubes from the mixed concrete as deposited in the work. Two cubes are taken from every 500 cubic yards of concrete laid; this, in the case of a concrete highway 16 ft. wide and of our standard thickness, represents about 1,700 lineal feet of roadway. These specimens are stored in moist sand near the highway for 21 days, at which time they are sent to the laboratory, where, at 28 days, they are tested for compressive strength. The engineers on the highways are notified of the results of such tests; and this seems to have promoted a friendly rivalry between them to endeavor to obtain the best possible concrete. This pride in accomplishment certainly tends toward obtaining desired results. The chiefs of the department do all in their power to build an excellent type of highway; but, in the end, much depends on the engineers directly in charge.

By means of the above described tests, I know we obtain a good quality of aggregates; and the final tests on the field cubes gives us an excellent check on both material and workmanship. But we also realize that the using of concrete for highway surfacing introduces the factor of making a concrete to resist impact and abrasion. This at present is well taken care of by using a rich mixture; but at the same time we are studying both concrete and mortars from this standpoint, and hope in the near future to be able to devise some method of testing the abrasive and impact resistance of various aggregates.

Mr. Mattimore supplemented his paper by presenting a number of tables and curves embodying interesting features brought out as a result of the tests. The curves, for example, in the diagram herewith reproduced, show the relative compressive strength of 1:1½:3 concrete made from different aggregates. Their main value is that they are the results of field tests, thus giving a good illustration of the concrete obtained in actual practice. This is a good, fair comparison of stone and gravel concrete, as both of these aggregates were of high grade, particular attention being paid to obtain a clean, uniform product passing all requirements for this class of concrete. It will be noticed that the material made with screenings, although showing a fair compression strength, is much below that obtained with a good sand. These latter cubes were made from concrete placed on highways previous to the adoption of the specifications quoted above.

On 1:2½:5 concrete, similarly made from different aggregates, compressive strength tests at 28 days brought out the results shown in the accompanying table.

Aggregates	Age	No. of cubes	Compression Break Lbs. per. sq. in.
Slag and sand	28 Days	16	2000
Stone and sand	28 Days	134	1990
Gravel and sand	28 Days	142	1895
Stone and screenings .	28 Days	28	1740
Coated gravel and sand unwashed	28 Days	48	1170

Complete New Track Entirely Before Putting it in Service

PUTTING new railroad tracks, such as additional mains, into service just as soon as they are safe for operation often proves to be a false economy; and closing the construction accounts before all work properly chargeable to the construction is completed throws an unfair burden on maintenance costs, comments a writer in The Engineering Record.

A few weeks, or often a few days, additional time will probably enable the construction forces to complete work, which, while perhaps not apparent to the operating official, will nevertheless cause considerable loss and additional expense if not done before the new track is thrown open to traffic. In cases where the roadbed is constructed of certain kinds of material, irreparable damage is done by permitting the continuous use of the track, even by work trains, before ballast is applied, or even after only a light ballasting has been effected. In such cases the ties will seat themselves in the roadbed, forming water pockets which will probably constitute a permanent cause of trouble. Tracks put into service before a permanent surface on heavy ballast has been completed are liable to costly injury through bent rails, battered joints or broken ties.

Even after the new track hs been opened to regular traffic for some time, in no case should the work be considered completed until a final raise has been made and the necessary ballast placed to bring the track up to its permanent cross-section. If the track is to be properly maintained, such a raise will very probably be necessary, and the cost of this should be considered a proper charge to the construction account, and not left unjustly to increase maintenance costs.

The Vancouver Club, Vancouver

THIS fine building was erected and completed last year at a cost of $300,000. It is constructed according to the Hennibique system, of reinforced concrete, and is eighty by two hundred feet in dimensions, with five storeys and basement. On the Hastings Street elevation it is faced with Hebron pressed brick and terra-cotta. The other elevations are finished with cement plaster, the site being an inside one. On the first floor there are a large entrance hall, various offices, cloak-rooms, lavatories, bar, reading and magazine rooms. The second floor, which is approached by a wide marble staircase, contains a large dining-room, finished in Austrian oak. A private dining-room, reached by a separate staircase, communicates with this room. On the third floor are the billiard room and card room, the fourth and fifth floors being given over to bedrooms, of which there are twenty-eight, with fifteen bathrooms.

The fine new premises of the Vancouver Club.

The basement has accommodation for a staff of twenty-five persons, with separate dining and recreation rooms. Provision is also made on this floor for bakery and vegetable supplies, wine and beer cellars, and refrigerating rooms. The boiler room, with vacuum cleaning plant and electrical control panels, are also placed on this floor.

A separate entrance on the Hastings Street elevation gives access to the ladies' portion of the club. A third entrance leads to the servants' quarters, and the steward's office controls the supplies which are delivered through this entrance. A freight elevator serves all floors. A large passenger elevator and two dumb-waiters are planned in suitable positions.

The building is heated by steam—with radiators in the small rooms and hot air in the large rooms—with ventilating system in addition operated by electric fans, this being in fact a modified Plenum system.

The furniture was supplied by Messrs. Waring & Gillow, of London, England, and the electric fixtures were manufactured by Messrs. Cope & Son, of Vancouver.

The design of this building was secured in open competition by Messrs. Sharp & Thompson, architects, Vancouver.

Perhaps the greatest defect in the method heretofore generally prevailing, of building highways by issuing bonds, has been the failure to provide for maintenance of the road after it is built. Only in rare instances have officials faced frankly the cost of maintenance and repair of bond-built highways at the time the bonds were issued and before construction began. Maintenance, however, is necessary in order to insure to the community the maximum economic service of a road, and to preserve the investment so that when the bonds are redeemed there will be something to show for the outlay. The cost of maintenance and repairs, therefore, should be studied at the very outset.

Dining Room, looking towards Minstrel Gallery.

Entrance Hall and Lounge.

Advantages in Use of Commercially Hydrated Lime Over Ordinary Lime

By E. W. Lazell, Ph.D.*

EVERYONE is familiar with the fact that when quick-lime is treated with water a violent action takes place, the lumps of lime break up, heat is generated, steam is given off and after the action is completed, a paste or putty remains —the ordinary lime putty used for mortar. The fact that quicklime has changed its form from dry lumps to a wet paste and that heat has been generated prove that a chemical reaction has taken place; or that quicklime has combined chemically with water. It is a scientific fact that when any chemical change or reaction occurs exact amounts of the material are involved. In the chemical change which takes place when lime is quenched with water definite amounts of lime and water are involved; in slaking lime an exact amount of lime unites with an exact quantity of water, forming an exact amount of hydrated lime and it differs from the orginal quick-water is present to satisfy the calcium oxide (lime) then a dry powder will remain. This powder is hydrated lime and it differs from the original quicklime and from pulverized lime in its behavior towards water. When water is added to hydrated lime no heat is generated nor does the material slake, thus indicating that water has no further chemical action on the hydrate.

What is Hydrated Lime?—Hydrated lime of commerce is the dry powder resulting from the treatment of lime with sufficient water to satisfy the chemical requirements of all the calcium oxide.

Necessity for Exact Proportions of Lime and Water.—In the foregoing, emphasis has been laid upon the fact that precise amounts of lime and water react chemically. In other words, 1 lb. of lime requires a certain definite amount of water to form a perfect hydrate. If too little water is used in quenching the lime in the process of manufacture the lime will be burned in slaking and free lime, or lime which is not combined with water, will be present in the hydrate, rendering the material unsound. Plaster made from such hydrated lime will later pop and pit, due to the gradual slaking of the free lime by the moisture present in the atmosphere. Further, mortar made from such unsound hydrate generally works tough and non-plastic. The free, uncombined lime when present to any considerable extent will dry out the mortar, rapidly decreasing its strength and causing it to crumble. Free lime in hydrated lime is a dangerous ingredient and one which will always give trouble.

If too much water is used in the preparation of hydrate the material will be damp and wet, rendering it difficult to handle.

Obsolete Methods of Manufacture.—In the past, three methods were used to produce hydrated lime:

(1) Small pieces of lime were placed in a basket and immersed in water for a few minutes, until slaking began, when they were withdrawn and placed in a heap in order to conserve the heat and prevent the escape of the vapor; the material swelled, cracked and became reduced to a dry powder.

(2) Lumps of lime were placed in a heap and wet at intervals until the mass was equally moistened throughout. The slaking proceeded as in the first instance.

(3) Small pieces of lime were exposed to the air for a number of months and the lime absorbed both water and carbon dioxide from the atmosphere, falling to a dry powder. The powder consisted of dry sub-carbonate of lime containing about 10 per cent. to 11 per cent. of water.

These three methods of dry-slaking lime were crude and unless the greatest care was exercised, the resulting product contained particles of unslaked lime. The hydrate produced by these methods was generally short and possessed poor sand-carrying capacity; in fact, hydrated lime made by any of the above methods was suitable for use in agriculture only and such hydrate should not be confounded with hydrated lime manufactured by modern methods.

Modern Methods of Manufacture.—The modern method of manufacturing hydrate depends upon the addition of a definite amount of water to a predetermined amount of lime. By no other method is it possible to produce a hydrate which will contain sufficient combined water to satisfy the demands of the calcium oxide (lime) present. It is of the utmost importance that all the calcium oxide be in combination with water, otherwise the hydrate will be unsound and unsuitable for building uses. That all the lime be satisfied with water will be insisted upon in any specification which may be drawn for hydrated lime to be used in the building trade, and it is vital for each manufacturer to recognize that the formation of hydrated lime involves a chemical change requiring the presence of exact amounts of lime and water. Since the process is chemical, it requires the same careful supervision as any other chemical process, such as the manufacture of Portland cement. The production and use of hydrated lime have been more retarded by the manufacture of only partly hydrated lime than from all other causes. Any method of manufacturing hydrated lime continually to produce a perfect product must be based upon weighing the lime used and measuring the amount of water added.

Advantages of Hydrated Lime

From the Standpoint of the Manufacturer.—One of the great difficulties in connection with the manufacture of lime is the perishable quality of the product. Lump lime cannot be stored for any length of time without deterioration, thus making the operation of the plant dependent upon the season and the whims of the weather. Kilns must be fired up, damped down or put out, according to the season of the year and the condition of the weather. This unevenness of operation results in a high unit cost. Since hydrated lime can be stored in bins in a manner similar to cement, it is possible to make the operation of the plant more nearly continuous, thereby introducing economies in the manufacture and reducing the cost. The manufacture of hydrate also means a more extended market, as hydrated lime can be used for a number of purposes for which quicklime is not suitable.

Advantages to the Dealer.—Three principal advantages to the dealer are the ease in handling, less deterioration of the product and the freedom from fire risk. These three facts alone should convince the dealer that it is more economical to handle hydrated lime.

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Uses of Hydrated Lime.—In general it may be stated that hydrated lime is suitable for any use in the building trade to which lump lime can be put, and it would appear that as soon as the material comes into general use, its advantages will be found to far outweigh any disadvantages. The use of hydrated lime does away with the necessity of slaking lime to a paste, thus saving the space required for the slaking bed as well as the labor of slaking. By the use of hydrate it is possible to proportion the mortar so as to have exact quantities present, since this form of lime comes into the market in convenient packages of known weight. This point is always appreciated by the architect and engineer, as it is a well-known fact when lump lime is used, as much sand as possible is added with the result that the mortar is lean and possesses little strength. If hydrated lime is correctly manufactured and the particles of core removed by some process of separation, the resulting product will possess a higher grade of purity than the original lime from which it is made. The product will also be more uniform and these two facts appeal strongly to all users of lime.

Mortar made from Hydrate is Stronger than that Made from Slaked Lime.—In June, 1910, the writer presented the results obtained from an extended series of tests on mortars made from both hydrated lime and lump lime to the American Society for Testing Materials. One of the most important conclusions drawn from these investigations was that the mortar produced from hydrated lime was stronger than that produced from the corresponding lump lime slaked to a paste. This conclusion was to be expected, since it is possible to manufacture hydrated lime by mechanical means under good chemical control, which is more thoroughly slaked than it is possible to slake lump lime on the job. With lump lime, the user is always dependent upon the thoroughness of slaking, and it is well known that unless lime paste is run off and stored for some considerable time, there is no assurance of complete and thorough slaking.

Practically all those who have investigated the strength of lime mortars have recommended the use of hydrated lime in place of lump lime. In Bulletin No. 30 of the U. S. Bureau of Standards, the following statement is made: "The proportion of impurities in hydrated lime is generally less than in the lime from which it is made. In building operations hydrated lime may be used for any purpose in place of lump lime, with precisely similar results. The consumer must pay the freight on a large amount of water, but the time and labor required for the slaking are eliminated and there is no danger of spoiling it either by burning or incomplete slaking. For all building purposes hydrated lime is to be preferred to lump lime. By its use the time and labor involved in slaking may be saved and the experience of the laborer is eliminated as a factor in the problem."

If the use of hydrated lime in the building trade is to be increased, this can be brought about only by the manufacturers of hydrate preparing and marketing only such material as is sound and contains no free lime. There is an increasing demand for hydrate for use in concrete to render the material more plastic and dense. Hydrated lime can be advantageously used in all cement plaster and stucco to make them work smoothly and give a more pleasing color. In all these uses the soundness of the hydrate is the paramount requirement. No one would think of using unsound cement—why then, should they expect to use unsound hydrate?

The market for hydrated lime is present and a concerted action on the part of the lime manufacturers to exercise the care necessary to make a thoroughly hydrated lime will result in a more extended use of the material. It is to be hoped that the manufacturers will direct their energies along this line.—Concrete-Cement Age.

A Mast and Boom Concreting Plant

A unique plant for mixing and placing concrete at Fort Crockett, Galveston, Tex., is illustrated in Fig. 1. The work under construction consisted of a large number of concrete buildings, placed along a line about 2,000 ft. long. As buildings contain no massive concrete, but consist mainly of thin walls and floors, a portable type of plant was desired in preference to chuting from a number of towers. A small tower and plant, supported on a flat car, was first considered, but it was finally decided that the plant shown in Fig. 1 would be more efficient, due mainly to the elimination of chutes and the consequent loss of time which would necessarily result in changing them.

By referring to the illustration it will be noted that the plant consists essentially of a braced mast with boom attached. The mast, which is a 12 x 12-in. timber, is pivoted at both top and bottom so that it can be turned through an angle of about 300 deg., or until it comes in contact with the inclined braces. The boom, which also is 12 x 12 ins., in section, has a length of about 60 ft., being rigidly connected at right angles to the mast, at a height of about 45 ft. It is supported from the top of the mast, at three points along its length, by means of rods equipped with turnbuckles. Along the top of the boom there is a steel track upon which the trolley runs (see Fig. 1).

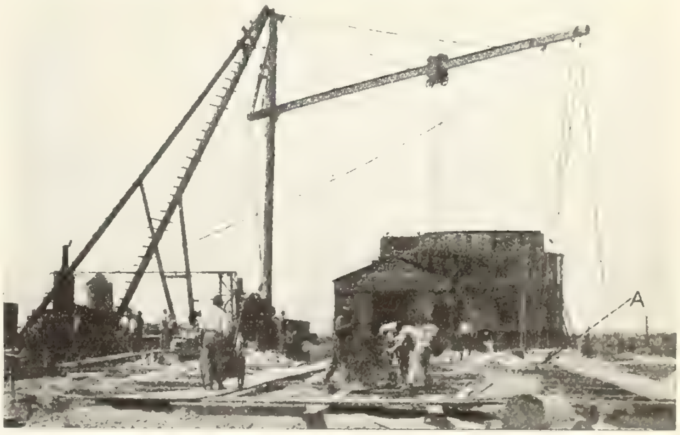


Fig. 1.—View showing mast and boom concreting plant in operation. Note arrangement of lines and positions of hoisting engine and mixer.

The mast is mounted at the apex of a large triangular frame, the inclined braces from the top of the mast being carried to the other apices of the triangle. This supporting frame is carried on three wooden trucks, located at the apices of the frame, each truck being fitted with four solid wooden wheels of very wide tread.

The equipment on the frame consists of a "Smith" mixer, mounted near the apex of the triangle at the base of the mast, together with a hoisting engine and boiler and a crude oil tank, placed at the base of the triangular frame. The boiler furnishes steam both for the mixer and for the hoist.

In operating, the bucket is placed under the discharge end of the mixer. After being filled, it is raised to a height just sufficient to clear the forms and other obstructions, and the trolley then run out along the boom the desired distance. The bucket is then lowered and dumped, after which it is brought back to the mixer by reversing the operations. It was necessary to use great care in performing these operations, especially when the bucket was suspended at a considerable distance from the trolley (as in Fig. 1). If the horizontal motion of the trolley was started or stopped too quickly a dangerous swinging of the bucket resulted.

The arrangement of the cables, by which the bucket and trolley are operated, is shown in the illustration. The boom is moved laterally by a modified tag line. By means of this arrangement one man can handle the boom with ease, by holding the line at the middle bight, at the point where it is shown tied to the stake (at A, Fig. 1). The entire plant is moved by block and tackle attached to a dead man and to the niggerhead of the hoist.

The plant is also used to drive piles, a pair of leads and a steam hammer being suspended from the boom for this purpose. After being placed the leads are held in position by spuds. With this arrangement it is easy to spot the hammer in position for driving the piles.

The equipment, which is described in a recent issue of Engineering and Contracting, was designed and used by James A. McGonigle & Son, contractors, of Leavenworth, Kan.

Irregularity of Employment: Its Effect on the Workman and on the Contractor

IRREGULARITY of employment is a demoralizing factor with which both the employee and the employer are now contending. In certain kinds of work it is reasonably certain that workmen will be able to secure fairly steady employment, while in other lines men have become accustomed to viewing such employment as temporary. In a measure, the rate of wage is based on the duration-of-employment factor, and the employer attempts, by wage adjustments, to give proper weight to it. It is doubtful, however, if contractors realize the extent to which irregularity of employment affects the efficiency of workmen. In building construction it is such an important factor that contractors are beginning to realize a better solution of it is necessary if they are to maintain success in such work. As building work is now conducted it is customary to retain the services of workmen only until they have finished their work on a particular building. In fact, even foremen, and sometimes superintendents, are employed only for a certain job. In general, it is practically impossible to enforce such corrective measures as the employer deems necessary from time to time, because the employee does not fear discharge, realizing that at best his employment is only temporary. The average employee who follows building work reasons that he can only hope to secure employment during a part of the year, and he often reaches such a state of mind that he does not even desire steady employment. The different wage scales adopted as standard in various cities also tend to increase his unrest. Most general contractors endeavor to keep throughout the year a certain part of their working organization; they have in their employ certain superintendents and foremen whom they endeavor to give permanent employment —many of them, however, evidently do not realize that a serious attempt should be made to retain the most efficient workmen. It is a known fact that men become attached to certain foremen and will make sacrifices to remain under their direction. We have known foremen whose greatest asset was their ability to assemble and retain an efficient force of workmen personally known to them.

In an attempt to solve this problem the Aberthaw Construction Company, which specializes in reinforced concrete building construction, has issued to certain of its more efficient workmen a "Record of Service Book." The holder of such a book is guaranteed a certain rate of wage so long as he remains in the employ of the company—no matter in what section of the country he is employed. The company also agrees to give the holder of a service book employment whenever there is a position open which he is qualified to fill; and the man is kept informed to new work as it comes up. The method used by the superintendents in signing workmen "in" and "out" on a job tends to spur the men to efficient service. When a man presents his book on a new job the superintendent fills in the left-hand page, giving the date on which work is started; when the job is completed the superintendent signs a statement that the man has completed his work on a given date. The book is then sent to the main office, where an officer of the company signs a "sticker" attached to the right-hand page, which indicates that the workman is in good standing. The service book contains a definite description of the man, to prevent its being transferred, a carbon copy of this description being kept at the main office.

It has been found that the use of this system has been effective in retaining good men and in making it easier to handle them to the best advantage. The possession of a service book by a workman is a recommendation of proficiency, and it can be used as such in case the workman is not given steady employment by the company, and finds it necessary to seek work elsewhere. Activity of this kind, which tends to encourage regularity of employment, is to be commended; and it is encouraging to note that more attention is being given to this important factor.—Engineering and Contracting.

The order of turning in the hand mixing of concrete should be so regulated that the last turn made will place the material in a single pile, at or near the centre of the board, preparatory to its removal to its place in the work.

New Immigration Buildings at Vancouver

THE view shown herewith is the Dominion Immigration Department's new building at Vancouver, which is now nearing completion. This building occupies a frontage on Burrard Inlet. It is 212 feet long, 64 feet wide, and 75 feet high. It contains four storeys over its whole area, and a small storey in the central position for the operation of the ventilating machinery.

The interior construction is of steel frame, having all floor beams bearing upon the external walls, which are carried up in solid brickwork varying in thickness from 25 ins. to 13 ins. All floors are of continuous reinforced concrete slab.

The chief feature of the building is its foundation. The level of the basement floor being only 4 ft. 6 ins. above extreme high water mark, and approximately one-half of its area over the water at high tide, a very solid and heavy foundation has been provided. The whole building stands upon reinforced concrete piles, the sea retaining wall having four rows on 3 ft. centres, and the remaining walls two rows. All interior columns are carried upon a nest of piles capped with concrete 2 ft. 6 ins. thick, and reinforced with 1-inch square bars in both directions. The whole of the piles were cast on the site. They are 16 ins. in diameter and octagonal in section, of an average length of 25 feet. The bottoms are pointed with a forged shoe strapped to the reinforcing steel, and all piles driven to refusal. A 3,500-lb. hammer was used for driving the piles and no excessive crushing was permitted, all heads being finally cut off to a uniform level and the steel bonded to the reinforcing bars of the foundation caps.

The accompanying photograph was taken during the process of casting the piles and conveys some idea of the number of piles used and the class of foundation upon which the building stands.

The sea retaining wall extends to a depth of four feet below low water mark. It is 11 ft. thick at the base, and 4 ft. thick at the top of mass concrete, with ends returned in similar construction as far as high water mark.

Creosoted fir sheet piling is provided at the foot of this wall, and will be cut off at ground level upon completion. This line of sheet piling was put in with 4-in. tongued and grooved fir, well supported from the bank, and formed a water-tight cofferdam for the construction of the sea wall at all periods of the tide.

The exterior of the building is executed in Kilgard pressed bricks with sandstone dressings, with a granite plinth extending 3 ft. 6 ins. in height the entire way round. The roof is covered with asbestos slates, and the over-hanging eaves, carried upon brackets, give the building a proportionate effect and a pleasing appearance.

Three staircases are provided, all of steel, two ex-

The Dominion Immigration Department's new building at Vancouver.

tending the full height, and there are two dumb-waiters and one elevator in the centre of the building. Suspended metal ceilings are provided throughout. The floor finish is in cement, marble terazzo or B. C. fir, according to the requirement of the various rooms. All stair treads are marble, and a marble dado 3 ft. high surrounds all walls to stair wells.

The heating and ventilating equipment is provided upon most modern systems, there being two tubular boilers, rated at 70 h.p. each, installed, and 11,000 square feet of radiation distributed over the building.

The design is by the Chief Architect of the Dominion Government. The general contractors are Snider Bros. & Brethour, Limited, of Vancouver. The supervising architect is Mr. E. E. Blackmore, Vancouver.

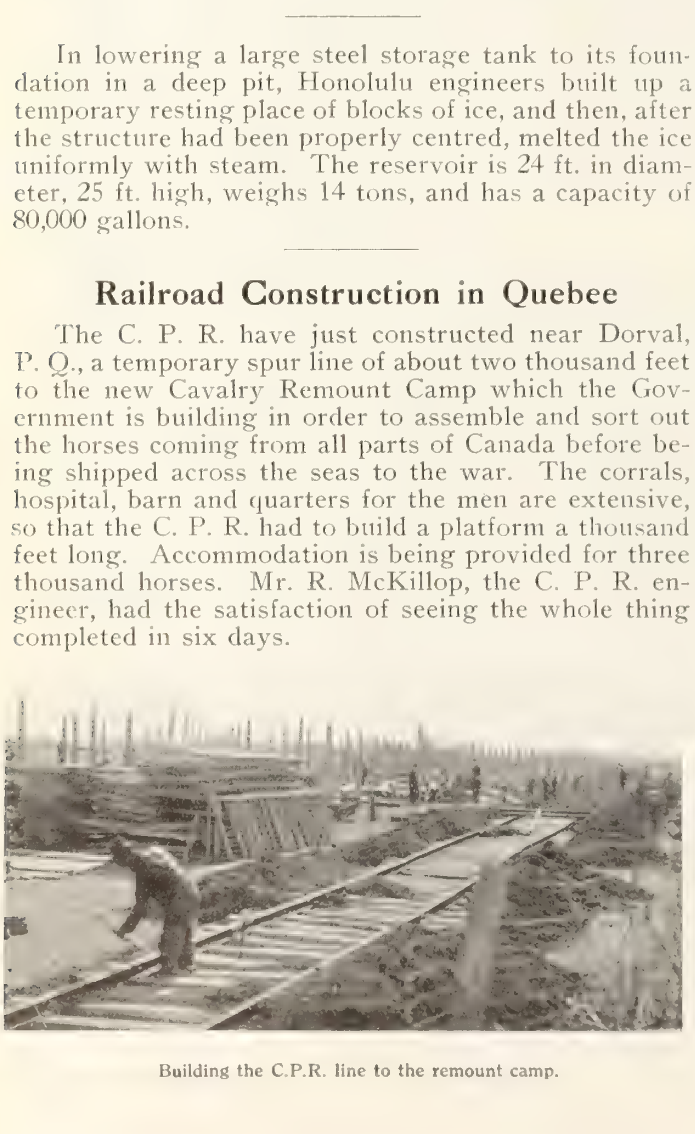
The structural steel was supplied by Messrs. J. Coughlan & Sons, and the heating, ventilating and plumbing was installed by Messrs. Barr & Anderson, Limited, both of Vancouver.

Railway engineers in countries where intense heat is experienced may learn something from the practice of the Southern Pacific Railway. The houses of the sectionmen—platelayers—are made of double walls of hollow tile, which keeps the houses cool by day, but warm and comfortable by night. Trees are also planted around the quarters, to provide shade, and, in addition, to make them more homelike. Their families live with the men, there being accommodation for from four to ten families in each block of buildings.

In lowering a large steel storage tank to its foundation in a deep pit, Honolulu engineers built up a temporary resting place of blocks of ice, and then, after the structure had been properly centred, melted the ice uniformly with steam. The reservoir is 24 ft. in diameter, 25 ft. high, weighs 14 tons, and has a capacity of 80,000 gallons.

Railroad Construction in Quebec

The C. P. R. have just constructed near Dorval, P. Q., a temporary spur line of about two thousand feet to the new Cavalry Remount Camp which the Government is building in order to assemble and sort out the horses coming from all parts of Canada before being shipped across the seas to the war. The corrals, hospital, barn and quarters for the men are extensive, so that the C. P. R. had to build a platform a thousand feet long. Accommodation is being provided for three thousand horses. Mr. R. McKillop, the C. P. R. engineer, had the satisfaction of seeing the whole thing completed in six days.



Building the C.P.R. line to the remount camp.

The Welland Canal

FOR years the interest of those who follow the engineering of waterways has been centred in the Panama and the New York State Barge canals. They were tremendous projects, replete with details of the greatest interest to engineers, both in design and construction. Now that the work of building them is drawing to a close, interest will probably shift to the construction of the Welland Ship Canal, on which the Dominion Government will spend $50,000,000. And well will it deserve the attention previously given to Panama and to the New York work. Only those who have had occasion to look into the Welland designs carefully appreciate fully the magnitude of the enterprise. In length it is not noteable. Its locks, however, will stand with the great ones of the world. They are to have clear inside dimensions of 80 x800 ft., with 30 ft. of water on the sills, while each of them will have the great lift of 46½ ft. At Thorold will be constructed a flight rivalling that at Gatun, for though the locks themselves will not accommodate as big a vessel the lift will be greater. At this point there will be three of them in flight, each with a lift of 46½ ft., or a total lift of 139½ ft. Moreover, as at Gatun, the flight is double, one for upbound and the other for downbound vessels. In details the locks will be very interesting. The most unusual feature will be the use of swinging single-leaf gates. The adoption of this design followed only after a most careful study of all other alternatives. It would not be surprising if the Canadian peninsula just west of the Niagara River should become a Mecca for canal engineers during the next few years.—The Engineering Record.

The total cost of wood lathing should be about $8.64 per 100 square yards. Metal lath runs in weight from 2.65 to 2.84 lbs. a square yard, and the cost varies from 15 cents to 20 cents a square yard. The total cost per 100 square yards for metal lathing should not be much over $18.50. These figures include the cost of scaffolding and are on a 6,000-sq. yd. basis.

A large wooden pipe at the hydro-electric works at Eugenia, Ont., collapsed last week. The pipe was under a 20-ft. fill, and the weight of the fill crushed the pipe. The mishap will necessitate the clearing of the fill, and the wood pipe will be replaced with one of concrete. It is expected that this will take three months to complete, and it is unlikely that power will be turned on before August next.

A hint to contractors, builders, and property owners generally, is embodied in the case just disposed of in the Court of Review, Montreal, when their Lordships unanimously reversed the finding of the lower court in the case of Chevalier vs. Tompkins. Briefly, the facts are as follows: Chevalier, a bricklaying contractor, sued Tompkins for $190.50, the balance of the contract price for certain brickwork done. The defendant refused to pay because the work was done badly and the building condemned by the building inspector. It was held that since the plaintiff built the wall knowing that conditions would render his work useless, he should not have built it, and that therefore his action to recover the contract price could not be upheld.

Sir John Jackson, M.P.—Engineer-Contractor

Specially Written by the London (Eng.) Correspondent of The Contract Record

AMONG contractors for public works, Sir John Jackson holds a high position, and if his firm, Sir John Jackson, Limited, is not the largest it is at least one of the two largest in the United Kingdom. He was born at York in 1851, educated at York and Edinburgh Universities, and his first contract came to him some twenty-five years later, and from the date of that he has never "looked back." One huge undertaking has followed another, and he is the very exemplification of the saying that "nothing succeeds like success." Space allows of little more than a bare catalogue of the more important of his works.

The completion of the Stobcross Docks at Glasgow was his first big contract, and the four years allowed for the job were reduced by him to three, in spite of the fact that the docks were constructed in quicksands. Then came the extension of the Middlesburgh, the Hartlepool and the North Sunderland Docks, the extension of the Fort at the end of the Admiralty Pier at Dover, and the completion of the last eight miles of the Manchester Ship Canal. The Dover Commercial Harbour, the foundations of the Tower Bridge, the docks and basins at Swansea and Methil, the breakwater and docks for the Burntisland Harbour Commissioners, and the deep dock at Barry followed, with many other works of an incidental kind.

Sir John Jackson

Among the undertakings of a gigantic nature carried out by him —or by his firm, which is much the same thing—precedence so far as importance goes must be given to the extension of the Admiralty Works at Keyham, Devonport. The cost of this undertaking was nearly £4,000,000, and the arduous nature of the work including the carrying down of foundations to solid rock, which was found in some instances only after going 110 feet into the mud—entailed an eight-years struggle. Another Admiralty job was the construction at a cost of some £2,000,000 of the Naval Harbour and Graving Dock at Simon's Town, Cape Colony. For Spain he has built the new arsenal at Ferrol; for Chili the railway across the Andes (joining Arica on the Chilian coast with La Paz, the capital of Bolivia) at a cost of £3,000,000; for Turkey the first part of the irrigation works in Mesopotamia which were designed by Sir William Willcox and estimated to cost over £18,000,000. This first part is the Great Hindiat Barrage across the Euphrates, which was opened recently by the Vali of Bagdad.

Now in hand by the firm are water supply and irrigation works in the Lebanon district of Syria; works in connection with Singapore Harbour for the Government of the Straits Settlements; and the new breakwater at Victoria, B.C., for the Dominion Government. Certain surveys and proposals to the Russian Government were made by Sir John for a second Trans-Siberian Railway, estimated to cost £20,000,000, but the war has stopped consideration of the scheme.

The light of a man of such experience and ability as Sir John cannot, however retiring the individual may be by disposition, be hidden under a bushel, and it is only to be expected that his advice and assistance have been sought after by Governments, corporations, companies and individuals in all parts of the world. Reference has just been made to the proposed second Trans-Siberian Railway scheme. When the French engineers were discussing the feasibility of bridging the Channel from Dover to Calais Sir John was invited to attend the conference in Paris, and he was also invited to assist (on behalf of the Americans) at the conferences held for the consideration of the subject of the Nicaraguan Canal. When the British Government decided to inquire into the military preparations and other matters in connction wth the South African War, Sir John was appointed a member of the Royal Commission. These are but a few of the many instances that could be quoted.

In the War which at present bids fair to devastate Europe, the firm of Sir John Jackson is bearing its share of the burdens which are cast upon every member of the community. Its share may be of some profit to the firm, but that does not detract from the patriotism that prompted Sir John to offer the services of himself and his Junior Directors to the War Office. That the offer was accepted goes without saynig, and the firm was appointed as Superintending Engineers to the War Department immediately under Major-General Scott Moncrieff, Inspector-General of Fortifications. In the first instance they supervised and carried out work to the value of about half a million sterling, without any remuneration. Among the first works given to the firm was the construction of quarters at Grantham, Ormskirk, Purfleet for the Home Troops, and later on Salisbury Plain for the Colonial Troops. "So able an administrator as Lord Kitchener," it has been said, "saw at once that the ordinary army routine of contracts passing through half a dozen hands before a brick could be laid or a stick put up must be set aside and the customary red tape methods abandoned. Accordingly, subject to supervision by the Inspector-General of Fortifications and a final appeal to himself, Lord Kitchener gave Sir John Jackson what might practically be called a free hand. Nor have the War Office had cause to regret the new procedure. For not only has the experience of Sir John's firm saved the country thousands of pounds, but by working in many cases night and day and seven days a week, notwithstanding in some instances the shortness of labour, Sir John Jackson, Limited, have made wonderful progress with the hutments, the value of work done in one month on the Salisbury work alone being close upon half a million pounds sterling." Particulars of the work being done on Salisbury Plain would make a score of interesting articles. Villages have literally sprung up and a town is being constructed that will eventually accommodate eight times the population of Salisbury itself. Huts have been going up at the rate of two hundred a week! A special water supply with pumping station and an electric lighting installation are among the manifold works in connection with the "camp," together with a 4½-mile railway line, including a lattice-girder bridge 140 yards long, necessitating deep piling through the mud 40 feet to the chalk, which was completed and traffic running with twenty days. At Grantham, too, a line of 2½ miles in length was laid in 3½ days! Both feats seem almost incredible.

Many are the honors which have been conferred upon Sir John. He can place after his name C.V.O., L L.D.,F.R.S.Edin., M.P., and J.P., while he holds the Grand Cross of Naval Merit (1st Class) of Spain, and is a Member of the Chilian Order of Merit (1st Class). He was knighted in connection with the Manchester Ship Canal work; and he received the Companionship of the Victorian Order on the completion of the Simon's Town harbour and dock, the Grand Cross of Naval Merit on the completion of the Ferrol Arsenal, and the Chilian Order of Merit as a reward for his railway work in Chili. His recreations are yachting, cycling and motoring, and he is a member of the Royal Yacht Squadron and the Royal Western Yacht Club, and Commodore of the Royal South-Western Yacht Club. He represents Devonport and East Stonehouse in Parliament, as a Conservative.

"A great engineer, a great contractor, a great traveller," it has been said of him, "few men have led a busier or more active life, few men's work will leave a more indelible mark on the history of things which count and things which last. Essentially a man of action Sir John never lets the grass grow under his feet. When once he decides to do a thing he does it with all his might. Like all men of business, he does not care to waste time in talking that leads to nothing, but will readily listen to a reasonable statement, and is fair and just to all. He soon forms an opinion of a person and is seldom wrong in his judgment. A broad-minded man in every sense, Sir John is generous to a degree, and never so happy as when entertaining his friends. His kind-heartedness is proverbial. He likes calling a spade a spade, and often delights his audiences by speaking his mind freely on matters on which he feels a word in season will do good morally and physically. A hard worker himself, he has no use for shirkers, and a man who is not prepared to pull his oar in the boat need not apply for work to Sir John Jackson. Honesty of purpose and strict attention to business, combined with many natural gifts, have placed him at the head of his profession, and right well does he deserve the brilliant success he has achieved."

Free sand imported from Europe is being used in the construction of the new subways in New York City. This is not because suitable sand cannot be obtained in this country, but because the war in Europe has cut down the cargoes which steamships ordinarily bring from the other side of the Atlantic to such an extent that it is necessary for many ships to come over in ballast, and they have been using beach sand as ballast. Upon arriving in New York this sand is discharged to make room for the returning cargoes, and is practically given away by the steamship company to anyone who will haul it away and dispose of it.

Maintenance of Concrete Pavements

THE following recommendations as to proper methods of maintenance of concrete roads, given by Cement World, are based on a survey of the results of up-to-date practice in various parts of the country:

1. The imperfection to be repaired should be thoroughly cleaned by brushing until all loose particles have been removed.

2. If the imperfection extends through the pavement and exceeds 6 inches in breadth or diameter, the sides should, after cleaning, be painted with cement grout, and the cavity filled with concrete of the same mixture and consistency as were used in building the original pavement. If a replacement, the excavation should be back-filled with gravel, well tamped, and the concrete properly reinforced. The repaired portion should be cured by being kept moist for at least four days, and protected from traffic until thoroughly hardened.

3. When a hole does not extend through the pavement, but exceeds ½ inch in depth, it should be carefully cleaned and dried, and then painted with hot tar. The hole is then filled with stone. Several sizes should be carried by the repair gang, the object being to use in any given hole a size of stone large enough to reach nearly from the bottom of the hole to the surface, but never to use stone exceeding 2½ in. in diameter. Where large sizes of stone are used, voids should be carefully filled with smaller sized stone and the whole tamped or rolled into place. Hot tar is then poured over the patch, gauging the quantity so that the tar will be absorbed without any large excess.

4. Holes less than ½ in. deep, cracks less than 1 in. wide, and expansion joints from which the filler has wholly or partly disappeared, should be cleaned, dried, and filled a little above level with hot tar, on the surface of which gravel or granite, from ⅛ in. to ¼ in. in size, should be spread from a shovel.

5. Refined coal tar should be used, having a specific gravity not less than 1.18 nor more than 1.25 at 77 deg. F. The tar should be heated to from 225 deg. to 250 deg. F. at the time of application, and may be applied by means of conical-shaped buckets with opening at apex, or by using a sprinkling can. Sand or screenings graded from ⅛ in. to ¼ in. should be spread over the surface, before the tar has cooled enough to prevent the sand from becoming firmly embedded therein to form a permanent wearing surface.

Home-Made Cements

One of the simplest hard cements is the well-known mixture of litharge and glycerine made to a stiff paste. It sets as hard as a rock and is oil-proof. A solution of water-glass mixed with powdered calcium carbonate serves the same purpose. A mixture of boiled linseed oil and fire clay resists acid better than most cements, though sulphur melted with glass powder is also ranked as very resistant to chemicals in general. A good stone cement is made by mixing two parts of magnesium oxide, one part of magnesium chloride, powdered stone to suit as filler, and water to make a stiff paste.

Hydro-electric plants in New England are producing more than 2,000,000,000 kw.-hr. of energy, which, if produced by coal, would mean the annual consumption of 3,000,000 tons of that fuel, according to figures given by Henry I. Harriman, President of the Connecticut River Power Company.

Personal Mention

Mr. Angus Smith, City Engineer, of Prince Albert, Sask., has gone to Fielding, Sask., on his annual vacation.

Mr. Thomas Hooper, whose photograph we reproduce herewith, is a well-known Vancouver architect. A native of Devonshire, England, where he was born fifty-eight years ago, he came over to Canada early in life, and engaged in contracting and building in Manitoba for five years. He went to British Columbia in 1886, and shortly afterwards was appointed Supervisory Architect to the Provincial Government. Mr. Hooper has built a number of the most prominent buildings in British Columbia—notably, at Vancouver. He is a member of the Pacific Club of Victoria and of the Terminal City Club, Vancouver.

Mr. Thomas Hooper, of Vancouver

Gunner A. I. Richardson, of the 5th Battery Canadian Field Artillery, who was killed in action at the end of April, graduated from McGill University three years ago as an architect. He was on the staff of Hogle & Davis, and of Brown & Vallance, and on the outbreak of war left Saskatoon and joined the 21st Westmount Battery in Montreal. Lance-Corporal W. H. MacNamee, killed in action, was at one time Montreal manager of the Philip Carey Manufacturing Company.

Mr. J. H. Hughes has been appointed electrical engineer of the Eastern lines of the C. P. R. in succession to Mr. J. A. Shaw, who has been made electrical engineer of the entire C. P. R. system. Mr. Hughes was formerly assistant to Mr. Shaw, and has been several years with the C. P. R., prior to which he was on the staff of the Montreal Light, Heat and Power Company.

Mr. Percy Booth, Montreal, is the winner of the George Creeford Browne scholarship in architecture at McGill University. This is of the value of $500, one condition being that the holder travels for the study of his profession for not less than three months and reports the results of his study on his return. Mr. A. B. Darbyson, of Montreal, won the scholarship last year, the present being the second year of the competition.

Mr. Joseph Race, City Chemist and Bacteriologist, Ottawa, has been requested by the Board of Works to undertake the examination of all materials used in connection with asphaltic roadway construction. Mr. Race has had previous experience of roadway work in England. He assisted in the preparation of the specifications which were ultimately adopted—practically without modification—by the Roadway Board of England.

Dr. T. A. Starkey, Professor of Hygiene at McGill University, has been appointed Major with the Canadian Overseas Contingent. He will organize the sanitary section of the Army Medical Corps, the unit consisting of 27 officers, non-commissioned officers, and men. Major Starkey will have under his charge the sanitary arrangements along the lines of communication with the British forces as they advance.

Mr. R. Leslie Meek, engineer for the Canadian Stewart Company at Fort William, Ont., and Mr. L. F. Grant, builder and contractor, of the same city, have gone to Kingston to join their corps. Mr. Meek and Mr. Grant volunteered some time ago for active service with the engineering corps of the Second Contingent.

A consulting engineer will be appointed by the City of Montreal to assist Mr. P. Mercier, Assistant Chief Engineer, while Major Janin is on active service. The names of two well-known local engineers, Mr. M. J. Butler and Mr. P. W. St. George, are being mentioned in connection with the appointment. It is thought probable that Mr. Butler, who is now connected with the Armstrong-Whitworth plant at Longueuil, will succeed Major Stuart Howard as head of the Sewers Department.

Mr. Thos. Adams, of the Commission of Conservation, Ottawa, spoke recently in Winnipeg on the subject of Town Planning. Mr. Adams' address was aided by a map showing the character of a town planning scheme in Great Britain involving 5,900 acres. He congratulated Winnipeg on the work which the Town Planning Commission had performed in the last four years. He said that the city offered a splendid field for such planning. He commented on the city's wide thoroughfares, and said that for this reason the improvements necessary in the central part of Winnipeg were very small. In closing, Mr. Adams said: "Under the proper scheme of planning throughout Canada we should be able to apply sanitation and hygiene in every city and village in the country. We have had a great heritage handed down to us, and we have a still greater heritage to hand down to the next generation."

Mr. Thomas Adams, of Ottawa

Mr. James A. Farrell, President of The United States Steel Corporation, was a recent visitor in Vancouver. In speaking before the Canadian Club, he said that his company had great faith in Canada and was backing up its faith with real money invested in the steel plant now under construction in Ontario, just across from Detroit. Mr. Farrell was most optimistic about the present trade outlook, and said that since the steel and iron business is a trade barometer it would be of interest to know that the company's mills were working to seventy per cent. of their capacity, and that this was an increase over the January operations of one hundred per cent.

Mainly Constructional

East and West—From Coast to Coast

It is believed that the Canada Cement Company will commence operations shortly at the cement works at Shoal Lake, Ont. The company have secured a Government order for 2,500.000 barrels to be used in the Welland Canal extensions. Next to the Panama Canal contract this is the largest order for cement ever given. Half the order is said to be for marl cement.

The Lock Nut & Specialty Manufacturing Company expect to commence operations in Hamilton, Ont., on June 1st, and before the year is out it is probable that two or three hundred men will be employed. The company will manufacture lock nuts and automobile wheels. Officers have been elected as follows:—M. J. Dunham, President; J. T. Stroud, Vice-President and Secretary-Treasurer; and C. V. Langs. Attorney for the company.

All work on the new Parliament Buildings at Winnipeg is to be stopped at once, while the Government make a thorough inspection of everything that has been done on it so far. An announcement to this effect was made at a session of the Royal Commission by the Hon. A. B. Hudson, Attorney-General. It was decided that the Commission should appoint a representative to be present when the Government prosecute their inquiries. Mr. John Woodman, architect, will be asked to act in this capacity.

The Dominion Bridge Company have lately received two bridge orders, involving an outlay of one million dollars. One of the new structures is to be built in New Brunswick, and the other in British Columbia. It is stated that work will be begun immediately on the bridge contracts, which will in no way interfere with the big shell orders already received by the company. The bridge section of the company has been working at low pressure for nearly a year, the shell manufacturing having been done in other departments of the plant.

Officials who were sent to British Columbia to investigate the proposed manufacture of brass in Canada through the refining of both copper and zinc in this country, have reported that it is quite feasible, and should be a profitable industry if aided at first by a small Government bonus. Brass is very necessary at present for the manufacture of munitions of war, and it is stated that the price could be lowered if it were manufactured in Canada. Britain would purchase part of the output. It is claimed that a saving of two cents a pound on copper for two years, with a demand like that existing at present, would pay the cost of establishing a refinery.

Seventeen million gallons of lake water a day will soon be available by conduit and pressure pipe in the city of Victoria, B.C. A ribbon of steel and concrete nearly forty miles long now connects Sooke Lake with Victoria, and although the system will not be in full operation until properly tested the Sooke water-works are practically finished. The work has cost more than the sum allowed in the original estimate, and the ratepayers have authorized an expenditure up to three million dollars, to include land damages; but it is hoped that this figure may be reduced eventually. The Water Commissioner expressed his satisfaction with the expedition shown by the Pacific Lock Joint Pipe Company, which has completed its section of the contract in less than the stipulated time.

Mr. J. L. Weller, Chief Engineer, still holds to his assertion that the Welland Ship Canal will be ready to open in 1918. Although the war has handicapped the work to some extent, and delayed the letting of the remaining contracts, the progress made on the great waterway is entirely satisfactory. Summer activity is well under way on Sections 1, 2 and 3. While enough excavation has been done on Section 3 in Thorold to change the whole face of the country affected, the work is really little more than started. In parts of this section it will be necessary to go down eighty feet more, partly through solid rock. At Port Weller more progress is to be seen. The walls of one lock are well up, and the water culvert in the lock wall is taking shape. The Boone Construction Company has taken a contract for dredging in the harbour, and while only one dredge is at work at present others will be on the job shortly. A 25-in. suction dredge will be employed at Section 5.

Ceresit Water Temple at the Panama-Pacific Exposition

THE Ceresit Water-Temple, illustrated herewith, stands in the Palace of Machinery at the Panama-Pacific Exposition. It is the exhibit of The Ceresit Waterproofing Company, Chicago.

In this exhibit the architect, Mr. E. B. Brown, of Stockton, Cal., has successfully accomplished the difficult task of combining beauty with utility.

The fountain at the pinnacle of the Water-Temple pours a constantly flowing stream of water over the cement dome, and this water runs along the eaves and then down through the eight supporting pillars of the Temple to its base, from which point it is pumped back to the roof again

There are plate glass inserts in each pillar, and the interior of each is lighted with concealed electric lights showing a miniature Niagara between walls of ceresitized cement; while the roof of the same material further illustrates the effective and permanent waterproofing qualities of Ceresit.

The Ceresit Water Temple.

A semi-indirect electric light gives a restful and pleasing effect inside the Temple, while the drinking fountain in the centre refreshes the tired and dusty sightseer.

The Ceresit Water-Temple stands 16 feet high and is a prominent feature among the many exhibits in the Palace of Machinery.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Auroroa, Ont.
The Town Council propose to lay a roadway on Wellington Street, estimated to cost about $10,000. Clerk, G. A. Petch.

Aylmer, Ont.
Prices are being received by the Town Engineer, H. LeBlanc, for the supply of 3,000 feet lead water pipe.

Bedford, Que.
Tenders will be received until June 4th for the supply and installation of approximately 15,000 lin. ft. 6-in. to 10-in. cast iron water mains; 35 hydrants and 20 valves. Plans and specifications at office of R. S. & W. S. Lea, Consulting Engineers, 830 New Birks Building, Montreal.

Brussels, Ont.
The laying of sidewalks is contemplated by the Town Council. Material not chosen. Clerk, F. S. Scott.

Chatham, Ont.
The City Council have had surveys made for the construction of 8-in. cast iron water mains on 5th, 6th and Wellington Streets. Contracts will be let for material only. Engineer, F. P. Adams, Harrison Hall.

The City Council contemplate laying granolithic sidewalks on several streets. Clerk, W. G. Merrill.

Colchester Township South, Ont.
The Town Council will shortly call for tenders on the construction of Tofflemire drain. Clerk, J. H. Maddill, Harrow, Ont.

Estevan, Sask.
Tenders will be received until June 5th by A. G. Garrish, Secretary to the Town Council, for the construction of three concrete culverts.

Fort Frances, Ont.
The Town Council will shortly call for tenders for extensions to the sewers and watermains and the construction of granolithic sidewalks. Clerk, J. W. Walker.

Hamilton, Ont.
The following road work will be constructed this year for the City Council: concrete sidewalks and curbs, $1,770; asphalt pavement, $45,923; asphaltic concrete pavement, $7,484; asphalt and asphaltic concrete pavement, $27,690; wood block pavement, $3,346. Engineer, A. F. Macallum.

Harrow, Ont.
The Town Council are contemplating the construction of sidewalks on Erie, Wellington and Lansdowne Streets. Clerk, J. H. Maddill.

Melancthon Township, Ont.
Tenders will be received until May 29th by the Township Council for the construction of an open drain about eight miles long. Plans and specifications at offices of Township Clerk, T. K. Slack, and Township Engineer, I. Traynor, Dundalk.

New Liverpool, Que.
The installation of a waterworks system here is contemplated by the Village Council. Commissioner, J. Hamelin.

Peterborough, Ont.
The City Council are considering the construction of sidewalks on various streets. Clerk, S. R. Armstrong.

Preston, Ont.
The City Council are considering the construction of a sanitary sewer and pavement on King Street, estimated to cost $5,600 and $21,100 respectively. Work not finally decided on. Town Clerk, H. C. Edgar.

St. Lambert, Que.
Tenders will be received until 6 p.m., May 31st, by the Municipal Council for the laying of approximately 5,570 ft. of concrete sidewalk and gutter, and 6,200 ft. of vitrified conduit. Plans and specifications and forms of tender at office of Municipal Engineer, E. Drinkwater, Town Hall.

Stamford Township, Ont.
Tenders will be received until June 7th by C. F. Munroe, Southend P. O., for the construction of one mile of concrete sidewalk, 4 feet wide. Engineer, T. C. Gardner, Queen Street, Niagara Falls.

Thorold, Ont.
The City Council are having by-laws prepared providing for the construction of about 12 miles of concrete sidewalk. Clerk, D. J. C. Munro.

Wallaceburg, Ont.
Tenders will be received until 8 p.m., June 1st, for laying watermains, sewers, sewer force mains and the construction of sewage pumping stations. Plans and specifications at office of Engineers, Chipman & Power, Mail Building, Toronto, and at office of Resident Engineer, Wallaceburg.

CONTRACTS AWARDED

Chatham, Ont.
The contract for the laying of a 12-in. glazed tile sewer on Lorne Avenue has been let by the City Council to Engineer F. B. Adams, Harrison Hall.

Hamilton, Ont.
The City Council have awarded the contract for the construction of sewers on Gertrude Street to Blair & Company, Woodstock, and for the construction of a sewerage system in Hamilton Park and McA'Nulty Surveys to Wilkes and Wallace, Manning Avenue, Toronto.

Moncton, N.B.
The contract for the laying of Tarvia paving has been let by the City Council to Carritte & Paterson, Water Street, St. John. Approximate cost, $28,000.

North Gosfield and Mersea Twps., Ont.
The general contract for a quantity of ditching has been let by these Municipalities to Percy Sandford, Kingsville, Ont., at $8,860.

St. Lambert, Que.
The contract for paving has been awarded by the Town Council to E. Belanger Company, 2820 St. Hubert Street, Montreal.

Toronto, Ont.
The contract for the construction of a sewer on Humewood Avenue, Township of York, has been awarded to McLaren & Company, Barrington Avenue.

Wallaceburg, Ont.
The Town Council have awarded the contract for the installation of water services to James Makioski. Work to start at once.

Railroads, Bridges and Wharves

Cap Chat, Que.
Tenders will be received until 4 p.m., June 18th, by R. C. Desrochers, Department of Public Works, Ottawa, for the construction of an extension to the training pier. Plans and specifications at office of District Engineer, Post Office, Quebec, with the Postmaster, Cap Chat, and at the Department, Ottawa. Construction, open-faced cribwork.

Petite Riviere Est, Que.
The Department of Public Works, Ottawa, will receive tenders until 4 p.m., June 14th, for the construction of a breakwater here. Open faced cribwork construction. Plans and specifications at offices of District Engineer, Quebec, the Postmaster, Petite Riviere Est, Que., and at the Department, Ottawa.

River Glade, N.B.
The Jordan Memorial Sanatorium will receive tenders until June 1st for the erection of a dam and bridge over the Pollett River here. Plans and specifications at office of Engineer, Railways Department, Fredericton, with Hon. C. W. Robinson, Moncton, and at office of Provincial Government, St. John.

Waterloo, Ont.
Tenders on the construction of two concrete arch bridges in this town are being received by Bowman & Connor, Civil Engineers, Berlin.

York Township, Ont.
Tenders will be received until noon, June 7th, by the Township Engineer, F. Barber, 57 Adelaide Street East, Toronto, for the construction of reinforced concrete beam bridge on Lansing side Road. Plans and specifications at office of Engineer. Approximate cost, $5,000.

CONTRACTS AWARDED

Arran Township, Ont.
The contract for the construction of a double arch concrete bridge has been

let by the Township Council to James Cole, Owen Sound.

Sandwich, Ont.
The Town Council have let the contract for the construction of a dock to Candler Dock & Bridge Building Company, 305 Moffat Block, Detroit, Mich., at $6,950. Oak piles, cement and sheathing will be required.

Public Buildings, Churches and Schools

Beamsville, Ont.
The School Board are considering the erection of a High School. Chairman, Mark Fampton.

Carroll, Man.
Tenders will be received until 5 p.m., May 29th, by F. H. Carroll, for the construction of a brick veneer school, estimated to cost $8,000. Architect, E. D. Tuttle, 705 McArthur Building, Winnipeg.

Fisher River Reserve, Man.
Tenders will be received until noon, June 21st, by Duncan C. Scott, Department of Indian Affairs, Ottawa, for the erection of a combined school and teacher's residence. Plans at Post Office, Hodgson, Man.; Halfway Post Office, Man.; Indian Offices at Portage La Prairie and Winnipeg; at the school, Fisher River, and at the Department, Ottawa.

Hamilton, Ont.
Plans and specifications are being prepared for the complete re-wiring of the City Hospital, Chairman of Board, J. H. Pratt.

Montreal, Que.
Sub- tenders on plumbing, roofing and electrical work required in repairs to the Court House here are being received by J. B. Gratton, Limited, 82 Mercier Ave.

Port Daniel, Que.
Rev. J. P. Cyr, Parish of Port Daniel, will receive tenders until May 29th for the construction of a steeple and for roofing the church and sacristy.

Todmorden, Ont.
St. Andrew's Anglican Church are about to raise funds for the enlargement of their parish hall. Rector, Rev. A. A. Bryant, 168 First Avenue, Toronto.

Toronto, Ont.
Tenders will be received until May 28th by the Board of Education for the erection of Jesse Ketchum School. Cut stone, steel and brick construction. Estimated cost, $185,000. Plans and specifications at office of Superintendent of Buildings, City Hall.

The Board of Education will receive tenders until May 28th for terrazzo floors at Niagara Street School, electrical work at Frankland School, collapsible gates at Manning Avenue School, cabinet work, plumbing and local telephones for various schools. Plans, etc., at office of Superintendent of Buildings, City Hall.

Wheatley, Ont.
The School Board contemplate the erection of an addition to the school estimated to cost $9,000. Secretary, Dr. A. M. Wilson.

CONTRACTS AWARDED

Lougheed, Alta.
The general contract for the erection of a brick veneer school in District No. 1792 has been let to C. W. Pettifer, Box 2301, Calgary. Approximate cost, $7,000.

Norwich, Ont.
The contract for the installation of interior fittings in the local post office has been let by the Department of Public Works, Ottawa, to Walker Bin & Store Fixture Company, Limited, 152 Shanley Street, Berlin.

Shaunavon, Sask.
The general contract for the erection of a school here has been let by the School Board to Stephason & Uglam, Shaunavon, at $11,656.

St. Catharines, Ont.
The Collegiate Institute Board have awarded the general contract for the erection of a collegiate institute to Newman Bros., 75 St. Paul Street. Approximate cost, $100,000.

Woodlawn, Ont.
The contract for the erection of St. Thomas Church has been transferred to Bradford & Serson, Arnprior, Ont. General contractor is in the market for stone, lumber, etc.

Business Buildings and Industrial Plants

Amherstburg, Ont.
E. Shepley, Tilbury, Ont., is about to start work on remodelling premises for a picture theatre.

Brantford, Ont.
W. C. Lingstone, 88 Brant Avenue, will receive tenders until June 9th for the erection of a departmental store on Colborne Street. Plans at office of Contract Record, 347 Adelaide Street West, Toronto, and with owner. Stone, brick and steel construction. Approximate rost, $60,000.

Blenheim, Ont.
William Henry is considering the enlargement of his garage.

Brussels, Ont.
Pryne & Son are considering the erection of a feed mill.

Estevan, Sask.
The erection of a cold storage and pork packing plant here is being considered. Approximate cost, $20,000. Promoter, A. Harris, Clarendon Hotel.

Fort William, Ont.
The Massey-Harris Company, 915 King Street West, Toronto, are contemplating the erection of a warehouse at Marks and Arthur Streets. Work to start shortly.

Halifax, N.S.
Piercey Supply Company, Davidson Street, are erecting a frame warehouse at an estimated cost of $3,500.

Montreal, Que.
R. Marks, 687 St. Lawrence Street, has commenced the erection of a store and flats on St. Dominique Street, estimated to cost $5,000.

Ottawa, Ont.
Plans have been drawn for stores to be erected on Gladstone Street for Donald Fraser, 82 O'Connor Street. Brick veneer construction, stone foundation, felt and gravel roofing. Approximate cost, $3,500.

Work has been started on the erection of an office building for the Ottawa Electric Railway Company, 248 Albert Street. Architect, J. A. Ewart, Booth Building, Sparks Street. Approximate cost, $18,000.

Regina, Sask.
The projected market building for Mrs. T. B. Dugan will not be erected.

Sandwich, Ont.
Work has been started on the construction of an addition to the plant of the Canadian Salt Company. Cement block construction, concrete floors. Estimated cost, $15,000.

Sedgewick, Alta.
Alberta Farmers' Co-operative Elevator Company, Limited, contemplate rebuilding their elevator recently destroyed by fire. Work to be done under the supervision of the head office, Lougheed Building, Calgary. Estimated cost, $8,000.

St. Thomas, Ont.
E. S. Hatch is about to start work on the erection of a planing mill estimated to cost $5,000. White brick construction, concrete foundation, metal roofing.

Stettler, Alta.
Tenders will be called shortly by A. S. Welch, for the erection of a store and lodge hall for the Modern Woodman of America, Limited, Stettler. Architect, John Backstrom, Stettler. Approximate cost, $10,000.

St. Lawrence River, Que.
Tenders on the construction of a boathouse on Island No. 43 will be received until June 1st by B. F. Sharples, West Chester, Pa. Frame construction, cribwork foundation.

Toronto, Ont.
Work has been started on the construction of an addition to the store at 518 Yonge Street by F. Burgess, 36 Langley Avenue. Estimated cost, $4,000.

Vanessa, Ont.
Henry Bartholomew has commenced re-building his sawmill, which was recently destroyed by fire. Equipment will be purchased.

Wallacetown, Ont.
James Bobier contemplates the erection of fireproof farm buildings. This wass erroneously reported in a previous issue at Wallaceburg.

Weston, Ont.
Joseph Nason, Main Street, is receiving tenders for the erection of a store and apartments, estimated to cost $4,000. Brick construction, tar and gravel roofing.

Windsor, Ont.
The erection of a store and flats is being considered by W. K. Kaplan, Wyandotte Street. Brick construction. Approximate cost, $9,000.

CONTRACTS AWARDED

Aylmer, Ont.
The general contract for the erection of an automobile sales building has been awarded by the East Elgin Garage Company to Joseph Davis, Aylmer. Brick construction, felt and gravel roofing. Estimated cost, $7,000.

Danville, Que.
The contract for the construction of a barn for Ernest Comeau has been let to Victor Plourde, Danville.

Halifax, N.S.
The Department of Naval Service have awarded the contract for the erection of a naval workshop here to Rhodes-Curry Company, Amherst.

Hamilton, Ont.

In connection with the warehouse being erected on Cannon and Catharine Streets for Davis Bros., 2 Park Street South, the electrical contract has been let to A. Page, 68 Lorne Avenue. Plastering, painting, heating and plumbing contracts not let.

Kingston, Ont.

The general contract for the erection of a moving picture theatre on Princess Street has been let by Harry Martin, 13 Balaclava Street, to John W. Litton, 52 Frontenac Street. Fireproof construction.

Ottawa, Ont.

In connection with the theatre being erected on Queen Street for B. Stapleton, Queen Apartments, the contract for steel and tinsmithing has been let to McFarlane & Douglas, 250 Slater Street, and for roofing to L. K. Kalagov, 107 Friel Street.

Richards & Montgomery, 442 Lewis Street, have commenced repairs to stores and offices on Spark Street for Fred Henrey, care of Ottawa Truss & Surgical Manufacturing Company, Wellington Street. Work to be done by day labor. Approximate cost, $10,000.

Springhill, N.S.

Work has been started on the erection of a lodge hall for the Knights of Pythias by Victor Woodworks, Amherst, N.S. Estimated cost, $6,000.

St. John, N.B.

The Bank of British North America have let the contract for remodelling their branch at Union and Sydney Streets, to Edward Bates & Son, Duke Street. Estimated cost, $9,000.

Toronto, Ont.

The following contracts have been let in connection with an addition to the store of the Hamilton Hardware Company, 498 Dundas Street:—masonry, carpentry, plumbing, heating and painting, owners; plastering, W. Bradd, 20 Collahie Street; wiring, W. Sheppard, 345 Grace Street; roofing, Wardell Bros., 102 Essex Street.

A. H. Scott, 1678 Dufferin Street, has been awarded the contract for alterations to residence on Dovercout Road for J. M. Walkey, 326 Shaw Street.

The masonry contract for an addition to Hilton Bros.' bakery at 611 Gerrard Street East, has been let to Smallwood Bros., 97 Clinton Street, and the carpentry contract to T. J. Sproule, 54 Shanley Street. Estimated cost, $5,000.

Victoria, B.C.

The general contract for the erection of an undertaking establishment at Cormorant and Quadra Streets has been let to T. H. Brown, 717 Discovery Street. Estimated cost, $9,000. Architect, Jesse Warren, 503 Central Building.

Walkerville, Ont.

The general contract for the erection of a handle factory on Monmouth Road for Hartwell Bros., Chicago, Ill., has been let to Williamson Construction Company, Walker Road. Frame construction. Approximate cost, $4,000.

Winnipeg, Man.

The contract for alterations to the Belmont Hotel has been let to Claydon Bros., Furby Place.

Residences

Almonte, Ont.

P. McCallum has commenced the construction of a residence by day labor. Estimated cost, $6,000.

Belmont, Ont.

The erection of a residence, estimated to cost $3,500, is being considered by James Moore, c/o Amos Carrothers.

Charlottetown, P.E.I.

Wm. Leonard, Cornwall, P.E.I., contemplates the erection of a double frame residence on Fitzroy Street, at an approximate cost of $4,000.

Cottam, Ont.

J. A. Jackson, Essex, is considering the construction of a residence on Talbot Street. Estimated cost, $3,000.

Dundas, Ont.

Tenders on the erection of two residences on Jarvis Street are being received by W. H. Ball. Stone foundation, brick construction, shingle roofing. Estimated cost, $3,000 each.

Tenders are being received by J. A. Armes, Architect, Federal Life Building, Hamilton, for the erection of a residence on South Street for Chas. W. Sealey, Customs House. Brick construction, concrete foundation, shingle roofing. Approximate cost, $4,500.

Essex, Ont.

The erection of a residence on Victoria Street is being considered by Adolphus Hooper. Approximate cost, $3,000.

Halifax, N.S.

The City Building & Land Company, have commenced work on the erection of a frame residence on Duffus Street. Estimated cost, $3,000.

Work has been started on the erection of a residence on Shirley Street by D. P. McNeil, 80 Quinpool Road. Frame construction. Approximate cost, $3,000.

Lansing, Ont.

Work has been started on the erection of a number of residences on Poyntz Avenue by W. V. Dixon, 259½ Yonge Street, Toronto. Smaller trades will be sub-let. Approximate cost, $4,000.

Logan Township, Ont.

The erection of a dwelling, at an estimated cost of $3,000, is contemplated by Robert C. Melville, Logan Township, Moncrieff, Ont.

Melville, Ont.

Plans have been drawn by J. H. Rudy, Box 191, for a residence to be built on 8th Street by J. Rowan. Tenders will be asked for smaller trades.

Montreal, Que.

A permit has been issued for five flats to be built by S. Lamourex, 2224 St. Dominique Street, at an estimated cost of $4,000.

Wm. Boivin, 851 Marie Anne Street, has taken out a permit for three flats to be erected on 4th Avenue. Estimated cost, $3,000.

A permit has been issued to C. E. Grenier, 1199 Principal Street, for the erection of four flats, estimated to cost $4,000.

J. C. Frenette, 324 Breboeuf Street, has taken out a permit for the erection of ten flats on Fabre Street. Approximate cost, $7,000.

E. Lecavalier, 65 Cherrier Street, will receive tenders on all trades except masonry, steel, and interior fittings required in the erection of ten flats on St. Denis Street. Approximate cost, $15,000.

Ottawa, Ont.

E. Bellanger, 26 St. Francis Street, contemplates the erection of a residence on Melrose Street at an estimated cost of $3,100. Brick veneer construction, stone foundation, shingle roofing.

The erection of two residences on Belmont Street is contemplated by the Capital Contractors Limited, c/o W. H. Craig, 136 Bank Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $7,000.

A. E. Shver, 45 Powell Avenue, contemplates the construction of a brick venees residence on Findlay Street at an approximate cost of $4,000.

Port Rowan, Ont.

Plans for a frome residence are being prepared for J. E. McDonald. Approximate cost, $3,000.

Quebec. Que.

Alfred Demeules, 156 Stigmates Street, is building a residence by day labor. Brick and frame construction, concrete foundation, metal and asbestos roofing. Estimated cost, $4,000.

St. Marys, Ont.

Lochie Cameron, Water Street N., is preparing plans for a residence to cost $3,000. Brick construction, shingle roofing.

Streetsville, Ont.

Work has been started on the erection of a residence on Main Street for George Sparling, Concession 5. Concrete block construction, brick foundation, shingle roofing. Estimated cost, $3,800.

Thorold, Ont.

The Beaver Fibre Board Company have commenced the construction of four workmen's houses to replace those recently destroyed by fire. Approximate cost. $18,000. Site cleared for three more.

Toronto, Ont.

C. B. Bingham, 86 Moore Park Avenue, has commenced the erection of a residence estimated to cost $4,000. Smaller trades will be sub-let.

Work has been started on the construction of a residence on Melgund Street by R. A. Shields, 121 Hilton Avenue. Owner will sub-let smaller trades. Approximate cost, $4,500.

G. J. Custance, 94 Redwood Avenue, has started work on the erection of a pair of residences on Mountjoy Avenue. Brick construction, shingle, felt and gravel roofing. Estimated cost, $3,200.

H. Gilles, 29 Beverley Street, is building a brick residence at 71 Wineva Avenue. Smaller trades will be sub-let. Estimated cost, $3,000.

L. Battershill, 119 Vaughan Road, is building a pair of residences 68-70 Hendrick Street. Smaller trades will be sublet. Brick construction, shingle, felt and gravel roofing. Approximate cost, $4,000.

A. Abak, 6 Skipper Avenue, has started work by day labor on the construction of a brick residence. Estimated cost, $3,000.

Work has been started on the erection of a residence by E. H. Sharples, 71

Hillsdale Avenue. Smaller trades to be sub-let. Brick construction, shingle roofing. Estimated cost, $3,000.

Plans have been drawn for a residence to be erected on Ferndale Avenue by F. Knibb, 6 Ferndale Avenue, at an estimated cost of $3,750. Smaller trades will be sub-let. Brick construction, shingle roofing.

The erection of a brick residence on Harvie Avenue has been commenced by Moore Bros., 12 Kenwood Avenue. Smaller trades may be sub-let. Estimated cost, $3,000.

Plans have been drawn for a residence to be built at Braemore Gardens by Thomas & Richards, 301 Lonsdale Road. Brick construction, shingle roofing. Estimated cost, $4,000.

W. J. Sutherland, 1552 Bathurst Street, hs commenced the erection of six residences on Arlington Avenue. Smaller trades will be sub-let. Approximate cost, $22,500.

J. H. McLaren, 159 Briar Hill Avenue, is building a residence at 177 Blythewood Road. Brick construction, shingle roofing. Estimated cost, $4,000. Smaller trades will be sub-let.

Work has been started on the erection of a pair of residences on St. Clarens Avenue by A. Simpson, 180 Margueretta Street. Brick construction, shingle roofing. Estimated cost, $5.000.

West Flamboro Township, Ont.

John Ofield, Greensville, contemplates the erection of a residence, estimated to cost $3,000. Frame and concrete block construction.

Windsor, Ont.

I. S. F. Walker, Walkerville, is preparing plans for a residence to be erected on Ouellette Street for R. A. Holland, Assumption Street, Walkerville. Estimated cost, $12,000.

CONTRACTS AWARDED

Armitage P.O., Ont.

J. F. Smith has let the contract for the construction of a brick residence to I. S. Rose, Newmarket, Ont. Approximate cost, $3,000.

Bracebridge, Ont.

The masonry contract in connection with the residence being built for Mrs. Philip Leeder, Jr., has been let to W. Hoover, Bracebridge.

Brandon, Man.

The general contract for the erection of a residence for G. Fitton, 601 14th Street, has been let to Albert Good, 710 12th Street. Frame construction, concrete foundation, shingle roofing. Estimated cost, $3,000.

Mr. W. Wade has let the contract for the erection of a residence on 12th Avenue to F. C. Lissaman, 812 11th Avenue. Brick veneer and stucco construction, shingle roofing. Approximate cost, $3,500.

Cedar Springs, Ont.

The general contract for the erection of a parsonage for the Rev. A. R. Johnston, Cedar Springs, has been let to Wm. Nicholson. Frame and white brick construction, shingle roofing. Approximate cost, $3,000.

Essex, Ont.

J. A. Abbott has let the general contract for the erection of a dwelling to R. Fenwick, Cottam, Ont. Frame construction, shingle roofing. Estimated cost, $3,000.

Flesherton, Ont.

The general contract for the erection of a residence for James Vance, Durham Road, has been let to Henry & Son. Frame and brick construction. Approximate cost, $3,200.

Halifax, N.S.

John Ross, 84 Seymour Street, has let the general contract for the construction of a frame residence on LeMachant Street to F. Brodie. Estimated cost, $3,900.

A contract has been let to G. H. Wright for the erection of a residence on Jubilee Road for E. A. Wood, 47 South Street. Frame construction, concrete foundation, shingle roofing. Estimated cost, $8,000.

Hamilton, Ont.

The general contract for the erection of a residence on Leinster Avenue for L. R. Johnston, Erie Avenue, has been awarded to F. Barnes, 90 Jackson Street W. Smaller trades will be sub-let. Estimated cost, $4,000.

The contract for heating and plumbing in connection with the residence being built at James and Mackland Streets for H. L. Frost has been let to Adam Clark, Main Street W.

Langton, Ont.

Mrs. Sevenpiper has awarded a contract for the erection of a frame and brick residence to Bennet & Charlton. Approximate cost, $3,000.

Melville, Sask.

The masonry and plastering contracts in connection with the erection of a residence on Eighth Street for D. Pilon have been awarded to Melville Construction Company, Second Street, and the electrical contract to Pilon Electrical Company.

Maidstone Cross, Ont.

The contract has been let to Bethel Croft for the erection of a residence for A. Dawson, South Road. Frame and white brick construction, shingle roofing. Approximate cost, $3,000.

Montreal, Que.

The general contract for the erection of three flats on St. Charles Street for Tousaint Prefontaine, 810 Dorchester Street, has been let to Wilfred Chartrand, 2160 Gouin Boulevard. Estimated cost, $3,000.

The general contract for the erection of two flats on Rozen Street for Mrs. W. Secombe, 222 Congregation Street, has been awarded to U. Mongeau, 256 Liverpool Street. Approximate cost, $4,000.

North Bay, Ont.

The general contract for the erection of a residence at 499 2nd Avenue E., for A. Moore, 148 Sherbrooke Street, has been let to S. Moore, Fraser Street and First Avenue. Frame and brick construction, stone foundation. Estimated cost, $6,000.

A contract has been let to B. Martin, 163 Worthington Street E., for the erection of a residence for E. L. Banner, 160 1st Avenue E. Approximate cost, $6,000.

Ottawa, Ont.

The general contract for the erection of a residence on Russell Street for Frank Grichen has been let to John Pasch, 308 Creighton Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $3,500.

The contract for masonry in connection with additions and alterations to a residence on Cartier Street for E. Seybold, 80 Elgin Street, has been awarded to A. Garvock, 136 Lewis Street, and for carpentry to Richards & Montgomery, 442 Lewis Street. Other contracts not let.

R. Brown, 388 Main Street, has let the general contract for alterations and additions to a residence on Albert Street to James & Ramsay, 71 Fairmount Street, and the heating and plumbing contract to J. T. Blythe, Frank Street.

Palmyra, Ont.

The general contract for the erection of a residence here for Philip Bieber has been let to McAuliffe & Barker. Frame and brick construction. Estimated cost, $3,200.

Quebec, Que.

In connection with the erection of an annex to a residence for P. T. Legare, 241 Grande Allee, the following contracts have been let:—carpentry, L. H. Peter, Limited, St. Angele Street; roofing, E. Falardeau, Dorchester Street; painting, Gauthier Company, St. Joseph Street; heating, plumbing and electrical work, Jobin & Paquet, Cote d'Abraham Street.

Randolf, N.B.

The sub-contract for carpentry in connection with the residence being built for E. P. Baker has been let to Medley Belyea, Water Street West, St. John.

Sandwich. Ont.

Work has been started on the erection of a residence for Soper & Dupuis, 59 Ouellette Avenue, by W. H. Jones. Artificial stone, frame, stucco, hollow tile and brick construction, shingle roofing. Estimated cost, $5,000 each.

Sharon, Ont.

The contract for the erection of a brick residence here has been let by M. Ramsay to I. S. Rose, Newmarket. Approximate cost, $3,000.

Skipness, Ont.

The general contract for the erection of a residence for Robert Warmington has been awarded to Morton & Craig, Owen Sound. Brick construction. Approximate cost, $3,000.

South Gloucester, Ont.

The contract for heating and plumbing in connection with the residence being built for Rev. Father Prudhomme has been let to J. A. Langelier, 310 Wellington Street. Plastering and electrical work by day labor.

Toronto, Ont.

The general contract for the erection of a residence on Glenholme Street for W. H. Gemmill, 85 Somerset Avenue, has been let to S. R. Hughes, 81 Portland Street. Smaller trades will be sublet by owner. Approximate cost, $4.000.

C. James, 51 Neville Park Boulevard, has let the masonry contract in connection with the erection of a residence to A. E. Booth, 51 Kingswood Road. Carpentry contract to J. Pennington, 21 Pickering Avenue.

Welland, Ont.

The general contract for the erection of a residence on Regent Street has been let by Harry Jones to Fred Sparks. Brick construction, stone foundation, shingle roofing. Estimated cost, $3,200.

Power Plants, Electricity and Telephones

Bothwell, Ont.

Work is about to commence on the installation of a hydro power system here by the Ontario Hydro Power Commission, Toronto. Approximate cost, $5,000.

Brantford, Ont.

The Town Council are about to install concrete or metal lighting standards in all parks. Engineer, T. H. Jones.

Highgate, Ont.

The installation of a street lighting and power distribution system is being considered by the Town Council. Clerk, F. Littlejohn.

Huron Township, Ont.

The extension of the Huron & Kinloss Municipal Telephone System has been authorized by the Township Council. Clerk, Angus Martyn, Ripley, Ont.

Lynden, Ont.

The ratepayers will shortly vote on a by-law to provide for the construction of a hydro-electric power plant here. Estimated cost, $4,495.

Markham, Ont.

The Village Council have started work by day labor on extensions to the lighting system. Material is being purchased from the Provincial Hydro-Electric Commission.

Milverton, Ont.

The installation of a HydroElectric lighting system here is being considered. Town Clerk, W. D. Weir.

St. George, Ont.

A by-law has been carried providing for the installation of Hydro-Electric power. Estimated cost $6,000. Village Clerk, A. E. Green.

Thamesville, Ont.

A by-law has been passed providing for the installation of a Hydro-Electric lighting system at an approximate cost of $6,250. Town Clerk, W. J. Cryderman.

Wallaceburg, Ont.

Tenders will be received until 8 p.m.. June 1st by the Town Clerk for the construction of an electrical transmission line. Plans and specifications at office of Engineers, Chipman & Power, Mail Building, Toronto, and at office of Resident Engineer, Wallaceburg.

Wawota, Sask.

The Wawota Rural Telephone Company are about to issue debentures to the amount of $7.300 for the construction of a telephone system. Secretary-Treasurer, J. Birnie, Wawota.

CONTRACTS AWARDED

Avonlea, Sask.

The contract for the construction of a telephone system for the Sunshine Rural Telephone Company has been let to W. D. Craig, Princess Theatre Block, Regina.

Welland, Ont.

The Town Council have let the contract for the installation of a fire alarm system to Star Electric Company, Newark, N.J., at $4,926.

Miscellaneous

Bienfait, Sask.

The Village Council have been empowered to borrow $3,000 for the installation of a water supply for fire protection. Secretary-Treasurer, A. J. Milligan, Bienfait.

Berlin, Ont.

The Canadian Consolidated Rubber Company, 5 Breithaupt Street, is in the market for machinery.

Cabri, Sask.

The Vilalge Council have been authorized to borrow $5,000 for the purchase of fire equipment. Secretary-Treasurer, J. W. Hopton, Cabri.

Clachan, Ont.

The Clachan Farmers' Club is in the market for a supply of cement. Particulars from R. S. Spence.

Elmira, Ont.

A. M. Bowman, Box 86, Elmira, is in the market for steam radiators and valves. 1-inch to 6-inch black pipe, steel tanks, rotary pumps and steam specialities.

Kingston, Ont.

City Engineer R. J. McClelland, will receive tenders until 3 p.m., May 31st, for the supply of 12,000 Imperial gallons, more or less, of road asphalt, delivered f.o.b. Kingston.

London, Ont.

Tenders will be received until 4 p.m., June 2nd, by the City Clerk for the supply of (a) one modern chemical and hose car, equipped for carrying 1,200 ft. 2½-in. hose, and (b) the rebuilding of wrecked motor car into a combination chemical hose car or tractor for service truck.

Owen Sound, Ont.

The Town Council contemplate the purchase of a motor truck, estimated to cost $5,000 to $6,000. Clerk, Charles Gordon.

Pembroke, Ont.

H. J. Beatty, Pembroke, desires catalogues and information on fire extinguishers and sprinkler systems for a sash factory.

St. Raymond, Que.

The Municipality propose to purchase fire engines, hose and other apparatus. Clerk, J. E. Savory.

Zurich, Ont.

The Town Council contemplate the purchase of general fire fighting equipment. Clerk, F. S. Hess.

CONTRACTS AWARDED

Hamilton, Ont.

The Board of Control have let the contract for the supply of an electric motor to Canadian Westinghouse Company, Limited, Hamilton, at $3,325, and for the supply of a pump to Canadian Allis-Chalmers, Limited, 212 King Street W., Toronto, at $1,365.

Winnipeg, Man.

The Board of Control have let the contract for the supply of 1,000,000 to 1,500,000 feet of B.M. lumber to T. D. Robinson & Sons, 258 Portage Avenue, and for the supply of one 5,000,000-gallon turbine booster pump to American Well Works, Limited, Aurora, Ill.

The Greater Winnipeg Water District have let the following contracts:—supply of machine lathe shaper and pedestal, gasoline engine, line shaft and couplings, Williams Machinery Company of Winnipeg, Limited, 260 Princess Street; six railway motor cars, Canadian Fairbank-Morse Company, Limited, 300 Princess Street; six railway motor cars, Kelly-Powell Company, McArthur Building.

Fires

Anvil Island, B.C.

The brick works, belonging to Edward Cook, 1049 Nelson Street, Vancouver, has been destroyed by fire, with a loss of $30,000.

Beauport, Que.

Mathias Parent's store and residence have been destroyed by fire, with a loss of $25,000, covered by insurance. Owner will rebuild.

Birch Hills, Sask.

W. Clafton's residence has been destroyed by fire. No insurance.

A warehouse belonging to A. E. Engesetter has been damaged by fire to the extent of $2,500, partially covered by insurance.

Colborne, Ont.

A fire has destroyed the curling rink and damaged the following properties:—W. Morrow, livery barn; J. Reeve, implement store; P. G. Ireland. butcher store and residence; F. L. Webb, store and residences. Total loss, about $25,000.

Formosa, Ont.

The following properties have been destroyed by fire:—G. Seitz, residence and stable; W. Fedy, residence and stable, and A. Apperman, barn.

Grindrod, B.C.

Fire has completely destroyed a barn belonging to Bernard Rosoman.

Hochelaga, Que.

The Thibault Laundry Company have sustained a loss by fire of about $5,000. The company will rebuild.

Marmora, Ont.

Fire has destroyed the public school here, with a loss of $8,000. Secretary to the School Board, A. R. Jones, Marmora.

Mission City, B.C.

Fire has completely destroyed a wing of the Belleville Hotel, owned by H. Windebank. Lessee, W. R. Bryant.

Montreal, Que.

The premises of Dostert Bros., 458 St. Paul Street, have been destroyed by fire, with a loss of $10,000. Insurance, $3,000.

The carriage factory of A. Racine, Limited, 1990 St. Dominick Street, has been gutted by fire, and a number of automobiles and carriages destroyed.

Mount Forest, Ont.

A residence owned by George Street, Detroit, Mich., and occupied by James Leevitt, Mount Forest, has been destroyed by fire, with a loss of about $3,400. No insurance.

Myrtle, Man.

A log barn belonging to Thomas Kirk has been totally destroyed by fire.

Niagara Falls, Ont.

A residence on Bridge Street, belonging to A. R. Cook, 78 First Street, Niagara Falls, N.Y., has been destroyed by

(Continued on page 57)

Tenders and For Sale Department

TOWN OF ST. LAMBERT, P. Q.

Tenders for Sidewalks and Conduits

Tenders will be received up to 6 p.m., **May 31st, 1915**, at the office of the Town Clerk, for the laying of approximately 5,570 lineal feet of concrete 7-ft. sidewalk and 18-inch gutter.

5,630 lineal feet of quadruple vitrified conduit laid in concrete under sidewalk and 590 feet quadruple vitrified conduit under pavements at intersections of streets, etc.

Specification and form of tender may be had and plans seen at the office of the undersigned.

(Signed) E. DRINKWATER,
Town Engineer,
Town Hall, St. Lambert, Que.

21

Tenders Wanted

Sealed tenders, marked "Tender for Public School Building," will be received up to **Saturday, May 29th**, by the Secretary of the Board of Education, Oshawa, in whole or part, for the different trades required in the erection and completion of an eight-roomed Public School Building.

Plans, specifications and all particulars can be had from D. Tod, Esq., Chairman of the Board of Education, Oshawa; also at the office of the Architects. No tender necessarily accepted.

P. PUNSHON,
Secretary Board of Education,
Oshawa, Ont.

ELLIS & ELLIS,
Architects,
Manning Chambers,
Toronto, Ont.

20-21

Department of the Naval Service

Tender for 30 Ton Steam Wharf Crane—Halifax Dockyard

Tenders addressed to the undersigned at Ottawa, and endorsed "Tender for Steam Wharf Crane, Halifax Dockyard," will be received up to noon of the **1st of July, 1915**, for the manufacture, supply and erection of a 30-ton Steam Wharf Crane, of the Derricking Jib Type, for the above mentioned Dockyard.

The tender should be accompanied by an accepted cheque in favor of the Deputy Minister of the Naval Service, on a chartered Canadian Bank, for $1,600, which cheque will be forfeited should the successful tenderer decline to enter into the contract as agreed, or fail to complete the work in accordance with the conditions of the contract and specification.

Representatives of firms desirous of tendering are to state in making application for specification, the name of the firm manufacturing and erecting the crane observing that sub-letting any portion of the contract is inadmissable.

The specification and conditions of contract may be seen at the office of The Consulting Naval Engineer, Ottawa.

Newspapers copying this advertisement without authority will not be paid for same.

The Department does not bind itself to accept the lowest or any tender.

G. J. DESBARATS,
Deputy Minister of the Naval Service.
Department of the Naval Service.
—79499. Ottawa, April 30th, 1915. 20-22

Sealed tenders addressed to the undersigned, and endorsed "Tender for Supplying Coal for the Dominion Buildings," will be received at this office until 4 p.m., on **Thursday, June 17, 1915**, for the supply of coal for the Public Buildings throughout the Dominion.

Combined specification and form of tender can be obtained on application at this office and from the caretakers of the different Dominion Buildings.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so or fail to complete the contract. If the tender be not accepted the cheque will be returned.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, May 20, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—79876. 21-22

The Quebec Streams Commission

Proposed Storage Dam on the St. Maurice River

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Storage Dam at La Loutre on the St. Maurice River," will be received at the office of The Quebec Streams Commission, Room 264, Parliament Building, Quebec, until **twelve o'clock on Tuesday, the 15th of June next, (1915)**.

Plans and specifications can be seen on or after this date at the said office, or at the Quebec Streams Commission's office, Room 803, McGill Building, Montreal.

Parties tendering will be required to accept the fair wage schedule prepared or to be prepared by the Department of Labor of the Province of Quebec, which schedule will form part of the contract.

Tenderers are notified that tenders will not be considered unless made strictly in accordance with the printed forms.

An accepted bank cheque for the sum of One Hundred and Fifty Thousand Dollars ($150,000.00), made payable to the order of the Provincial Treasurer, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

O. LEFEBVRE,
Chief Engineer.
The Quebec Streams Commission,
Montreal, April 29th, 1915.

Newspapers inserting this advertisement without authority from the Commission, will not be paid for it. 20

Tenders for Pavement

Sealed tenders addressed to A. H. Millar, City Clerk, will be received up to **June 3, 1915**, for the construction of approximately 2,000 square yards of pavement in the city of Berlin. Alternative bids will be received for asphalt, bitulithic and vitrified brick. Plans and specifications may be seen at the office of the city engineer. The lowest or any tender will not necessarily be accepted.

HERBERT JOHNSTON,
City Engineer.
Berlin, May 18, 1915. 21

COUNTY OF HALDIMAND

Good Roads Committee

Tenders will be received for the construction of at least ten reinforced concrete highway bridges varying in span from 6 ft. to 32 ft., on or before the **14th of June, 1915**. Plans and specifications may be seen and forms of tender obtained at the office of the County Engineer, Dunnville, Ontario, any day after the 1st of June, 1915. Tenders to be addressed to

Mr. BAIN, Chairman,
Good Roads Committee,
R. R. No. 1, South Cayuga, Ont.

20-23

TOWN OF BEDFORD, QUE.

Proposal for Waterworks

Proposals will be received at the office of A. T. Gould, Secretary-Treasurer of the Town of Bedford, Que., until noon on **Friday, the fourth day of June, 1915**, for furnishing and installing approximately 15,000 linear feet of 6-in. to 10-in. cast iron water mains, 35 hydrants, 20 valves.

Plans and specifications may be seen after May 24th, 1915, at the office of R. S. and W. S. Lea, Consulting Engineers, 820 New Birks Building, Montreal, or may be obtained on deposit of $5.00, which will be repaid on the return of the same.

Each bid must be accompanied by a certified cheque for $2,000, drawn to the order of the Corporation of the Town of Bedford, Que.

The right is reserved to reject any or all bids.

MARVIN SMITH, Mayor.
Bedford, Que., May 19th, 1915. 21

Mail Contract

Sealed tenders, addressed to the Postmaster General, will be received at Ottawa until noon, on **Friday, the 2nd of July, 1915**, for the conveyance of His Majesty's Mails, on a proposed Contract for four years, six times per week each way, Markham (via Box Grove and Cedar Grove) Rural Mail Route, from the Postmaster General's pleasure.

Printed notices containing further information as to conditions of proposed Contract may be seen and blank forms of Tender may be obtained at the Post Offices of Markham, Box Grove, Cedar Grove and at the office of the Post Office Inspector, Toronto.

A. SUTHERLAND,
Post Office Inspector.
Post Office Inspector's Office,
Toronto, May 19th, 1915.
52 A.—5M.-25-7-13 21-23

Tenders Wanted

Sealed tenders addressed to the undersigned, **will be received up to June 4th,** for the rebuilding of Marmora Public School according to plans and specifications which may be seen by applying to the Secretary. Lowest or any tender not necessarily accepted.

G. B. AIRHART, Secretary,
21 Marmora Public School Board.

Bridge Tenders

Sealed tenders will be received by H. D. Ramsden, Esq., Reeve of East Gwillimbury, Mount Albert, up to noon, **Tuesday, June 1st,** for the construction of a 42 ft. steel bridge with concrete abutments about two miles from Brown Hill. For plans and other information apply to

BOWMAN & CONNOR,
Engineers,
21 31 Queen Street West, Toronto, Ont.

TENDERS

Sealed tenders will be received by the Clerk-Treasurer of the Town of Renfrew, up to **May 31st, 1915,** at 5 o'clock p.m., for a ten years' lease, with the option of purchase, of the property known as the Jamieson Brick Yard; also the purchase of the Machinery and Plant on the same.

List of machinery can be seen at the Clerk's Office. Highest or any tender not necessarily accepted.

J. A. DEVENNY,
21 Clerk-Treasurer.

Mail Contract

Sealed tenders addressed to the Postmaster-General will be received at Ottawa until noon on **Friday, the 25th of June, 1915,** for the conveyance of His Majesty's Mails on a proposed contract for four years, as required times per week each way, between Toronto Post Office, Postal Station "A," and railway depots from the 1st of September, 1915. Printed notices containing further information as to conditions of proposed contract may be seen and blank forms of Tender may be obtained at the office of the Chief Post-Office Superintendent, Toronto.

G. C. ANDERSON, Superintendent,
Post-Office Department, Mail Service
21 Branch, Ottawa, May 10th, 1915.

CITY OF LONDON, ONTARIO

Tenders for the Construction of Pavements

Sealed tenders addressed to the "Chairman and Members, Board of Control, will be received at the Office of the City Clerk up to 4 p.m. on **Wednesday, the 9th day of June, 1915,** for the construction of approximately:

(a) 18,000 square yards of asphalt pavement on concrete base.

Plans, specifications and all particulars can be seen at the office of the City Engineer.

Tenders must be accompanied by a marked cheque for five per cent. (5 p.c.) of the amount of the bid.

The lowest or any tender not necessarily accepted.

H. A. STEVENSON, Mayor.
H. A BRAZIER, City Engineer.
21

HESPELER WATER WORKS

Tenders wanted for:—
Excavation and Pipe Laying.
Concrete Reservoir.
Pumping Machinery.
Steel Water Tank.
For further information apply to

BOWMAN & CONNOR,
Civil Engineers,
21 Berlin, Ont.

Tenders for the Construction of Sidewalks

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, June 7th, 1915,** for the construction of concrete sidewalks on:—

Main Street, Ashbury, Gledhill, Brant, and Edmond Avenues, and St. John's Road, all in the Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Township Engineer.
Toronto, May 22, 1915. 21

FOR SALE

A Bargain, Parsons Trenching Machine almost new. Digs to twenty feet deep and up to five feet wide. Box 196, Contract Record, Toronto. 21-23

FOR SALE

Concrete Mixer, 12 ft. cap. "The Standard" Low Charging on truck, with high-grade gasoline engine, complete. New; never been used. In stock at Montreal. Extra low price. Write for particulars. The Standard Scale & Supply Company, 1345-47 Wabash Ave., Chicago, U.S.A. 19-22

Road Machinery

Large U. S. firm making a special line of road drags desires to secure sales representatives in both Eastern and Western Canada who have good connections with municipalities and public contractors. Apply, Box 201, Contract Record & Engineering Review, Toronto. 19-21

Fires

(Continued from page 55)

fire, with a loss of $4,000. Owner will rebuild shortly.

North Coaticook, Que.
V. A. Dawson's barn and implements have been totally destroyed by fire.

Pembroke, Ont.
The sash and door factory of the Pembroke Lumber Company has been destroyed by fire . Loss about $75,000.

Pilkington Township, Ont.
The residence of E. Dobberthein, Elora P. O., has been destroyed by fire. Loss partly covered by insurance.

Plenty, Sask.
The following buildings have been destroyed by fire:—Plenty Supply Company, warehouse; Hanbury Hardware Company, store; Cockshutt Implement warehouse and office; James McKenzie, seed warehouse and residence, and Gilroy & Brunt, general store.

Port Arthur, Ont.
Fire has destroyed an elevator belonging to The National Elevator Company, Limited. Head Office, Winnipeg. Loss. exclusive of contents, is estimated at about $65,000, covered by insurance.

Rivers, Man.
Fire has destroyed the residence of W. Bailey, causing a loss of $00,000 on house and contents, partially covered by insurance.

Rockwood. Ont.
A barn belonging to F. Garstang has been destroyed by fire.

Redcliffe, Alta.
The residence of A. Symon has been completely destroyed by fire.

Regina, Sask.
The London Cafe, proprietor, T. Dsolis, 1738 Hamilton Street, has been damaged by fire to the extent of $12,000. Insurance, $4,000. Owner will rebuild.

Three residences on Annex Street belonging to George G. Millar, 2251 Lorne Street, have been destroyed by fire. Loss, $3,000.

The lumber yard of the North West Lumber & Supply Company, Eighth and Ottawa Streets, has been destroyed by fire. Loss, $25,000, covered by insurance. Owners will rebuild their office, and equipment will be required.

Sioux Lookout, Ont.
The Lakeview Hotel, owned by J. Clark, has been totally destroyed by fire.

Stonewall, Man.
Fire has destroyed a warehouse belonging to G. H. Soundry, with a loss of $5,000. No insurance.

Thorold, Ont.
Fire has damaged the factory of the Beaver Fibre Board Company to the extent of $18,000.

Toronto, Ont.
Fire has gutted the factory of the National Mattress Felt & Batting Company, 340 Gerrard Street E. Loss on building, machinery and stock, $25,000, fully insured.

Late News Items

Bracebridge, Ont.
The masonry contract in connection with the residence being built on Ontario Street for J. H. Elliott, Manitoba Street, has been let to T. Hunt, Shier Street, and the carpentry contract to M. C. Newark, Hiran Street.

Calgary, Alta.
The City Commissioners will receive tenders until 2 p.m., May 27th, for the supply of paper insulated, lead covered underground cable. Specifications at office of City Electrical Engineer.

Eburne, B.C.
The Wilton Shingle Company's mill here has been totally destroyed by fire, with a loss of $10,000 on the building and plant.

Finch Township, Ont.
The contract for the construction of a drain has been awarded by the Township Council to Neil McRae, Finch, Ont. Engineers, Magwood & Stidwell, Cornwall. Approximate cost, $5,000.

Howe Sound, B.C.

The Department of Public Works, Ottawa, will receive tenders until 4 p.m., May 27th, for dredging Shoal Passage, Howe Sound. Specifictions at offices of C. C. Worsfold, District Engineer, New Westminster, B.C., J. L. Nelson, Superintendent of Dredges, Vancouver, A. F. Mitchell, Acting District Engineer, Victoria, and at the Department, Ottawa.

Montreal, Que.

The sub-contract for roofing the Orphanage on Decary Boulevard has been awarded to Sibley & Huota, 34 St. Martin Street. Painting will be done by the general contractors, Deakin Construction Company, Limited, 41 Mayor Street.

Point Grey, B.C.

The general contract for the erection of a residence for Mrs. Lefevre, 719 Jarvis Street, has been awarded to T. L. Gray, 1745 First Avenue E., Vancouver. Frame construction. Approximate cost, $15,000.

Portreeve, Sask.

Tenders will be received until June 5th by John Taylor, Portreeve, for the construction of a two-roomed school in District No. 3028. Plans and specifications with Mr. Taylor.

Toronto, Ont.

J. G. Churchill, 34 Columbine Avenue, has commenced the construction of a pair of residences on Lark Street for the Chartered Trust & Executive Company, 61 Yonge Street. Brick construction, shingle, felt and gravel roofing. Estimated cost, $4,000.

Vancouver, B.C.

The Vancouver & District Joint Sewage Board, 514-518 Birks Building, will receive tenders until 5 p.m., May 31st, for the construction of 1,600 feet of sewer outfall, supplied and laid complete. Alternative tenders will also be received for (1) 5-foot reinforced concrete pipe in trench, and (2) 6 feet in diameter mass concrete in shaft and tunnel. Secretary, G. W. Phipps.

Victoria, B.C.

The general contract for the construction of a storage warehouse for the British American Paint Company, Laurel Point, Victoria, has been let to R. Hetherington, 1153 Burdett Avenue.

White Rock, B.C.

The Dominion Government Department of Public Works have let the contract for the construction of an addition to the pier here to Fraser River Pile Driving Company, Front Street, New Westminster. Material will be supplied by the Department. Approximate cost, $10,500.

After the excavation had been completed for the basement of a power house, and the forms for the basement walls had been set in place, a sudden, heavy rainstorm filled the excavation to a depth of about 4 ft. before the contractor was able to place the concrete. As there was no pump available except an ordinary ditch pump, and as its use would result in idle men on the job, an injector was fitted up in the following manner to remove the water: A steam line was run out from the power house, and connected up to the intake pipe of the injector. The injector was then lowered to the bottom of the pit, being supported only by the pipe lines connected to it. The outlet pipe of the injector was run along the ground to a nearby catch basin. By means of this equipment the water was quickly lowered to such a level that a man could work within the excavation. A small hole, of sufficient depth to permit the injector to drop below the basement floor. was then dug, and the water removed from the excavation with the injector in this position. The injector was left in the pit until the job was completed and was found invaluable in taking care of water from subsequent storms.

The Taylor Engineering Company, Vancouver, B.C., have just installed for the Dominion Government in one of their Pacific Coast dredges, "The Fruhling," a De Laval turbine driven high pressure pump, consisting of a multistage centrifugal pump having a capacity of 1,175 g.p.m. against a total head of 460 feet. This pump is directly connected through flexible coupling to a 210 h.p. De Laval turbine, operating at 2,500 r.p.m., and exhausting to a 24-in. vacuum. The pump is a 2-stage, 6-inch, double suction type, and the complete unit makes a very compact installation. It is used for supplying high pressure water to assist in breaking up the material at the entrance to the suction of the main dredging pumps.

From the Link-Belt Company, Chicago, we have received a copy of the firm's Portable Wagon Loader Catalogue No. 210. This catalogue describes a machine that will load a wagon or truck with material carried on the ground at the rate of one ton a minute. The book gives illustrations, specifications, and net prices of standard wagon loaders, and shows some of the special machines which have been built to meet Government requirements. Wherever quantities of loose materials must be loaded into wagons or trucks with ease and despatch, and at a low cost per ton, the Link-Belt portable wagon loader should prove a profitable investment.

In order to keep the steel legs of transmission towers from rusting off where they enter the concrete base, the construction department of the Ohio Light & Power Company has originated a novel scheme for waterproofing this vulnerable point. While the concrete is still green small trenches 2 or 3 ins. deep are dug into it at the base of each leg, and the surface of the steel carefully cleaned of concrete. After the base has set, these trenches are filled with an asphalt compound, mixed so that it will not crack in cold weather and will not melt in a hot sun. If care is taken in pouring these joints, they can be made so tight that water cannot collect in them against the surface of the steel.

A paper recently presented by W. A. Aiken before the American Society for Testing Materials, embodies conclusions based on the results of about 400 careful tests made to determine the value of blast furnace slag as aggregate in concrete.

The slag used for the tests was commercially produced in Philadelphia, Pa.; the cement was a standard Lehigh Valley brand; and the sand was Jersey "gravel," which is widely used in the vicinity of Philadelphia. The test cubes were made 1:2:4, under conditions similar to those of filed work in concrete construction. Chemical analysis showed the slag to contain 34.40 per cent. silica, 23.40 per cent. alumina and iron oxide, 35.88 per cent. lime, 3.21 per cent. magnesia, 0.39 per cent. sulphur anhydride, and 1.27 per cent. sulphur, with a loss of 1.34 per cent. on ignition.

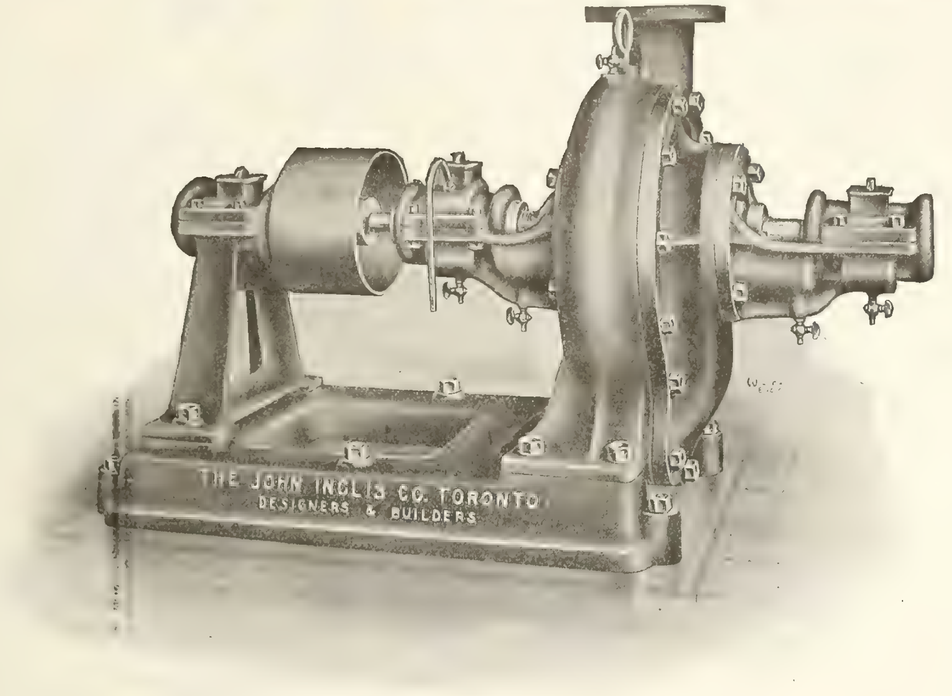
From the actual strength of the concrete; the weight of the slag per cubic foot (which is less than that of most material used similarly); the recognized solubility of slag, which permits it to act as a puzzolanic material; its alkaline nature, which is especially conductive to rust prevention in reinforced concrete construction; and from the relative high combined percentages of silica, alumina, and iron, making for permanency in the resulting concrete, it is concluded that slag of similar composition is in every way satisfactory for use as aggregate in concrete.

An interesting booklet received is one which describes and illustrates the products of the Vancouver Wood Pipe and Tank Company, Limited. Vancouver, B.C., manufacturers of wire wound wood stave pipe and steel banded continuous stave pipe for water-works, hydro-electric plants, irrigation systems, and domestic water supplies. Engineers and others who contemplate the use of wood pipe, and who wish to secure the best results from its use, will find this firm's specifications useful. The company not only manufacture wood pipe and tanks, but they are prepared to undertake the installation of complete water systems, both in iron and wooden pipe, and also the erection of all kinds of wooden tanks and towers.

Electric welding at a central plant expedited the fabrication of the steel hoop reinforcement used on a long concrete conduit for the Deerfield River power development at Hoosac Tunnel, Mass. The bars were bent over into the required shap and their butts were electrically welded. It was found in the final summing up that the saving in steel alone. obtained by doing away with the necessity of lapping these bars, as is the common practice, went a great way toward paying for the expense of the shop work. The expense saved in the field by eliminating the labor necessary to do the bending there and in the wiring together of the lapped ends was not accurately determined, but a concrete man can readily appreciate that it must have been considerable. Tests made on these hoops showed the welded sections to be the strongest parts of the hoops, due to the fact that there was naturally a greater area of cross-section at this point.

Slag and trap-rock concrete were recently compared by a 28-day test at Columbia University. Palisade trap-rock was used, separated in ¾, ½ and ¼-in. sizes, and dust, and combined so that the grading was identical to that of the slab, which was used as received from the National Slab Company. The sand was "Cow Bay," a typical Long Island sand, and the cement was a mixture of three approved brands, Atlas, Dragon and Kane. A mixture of 1:2:4 was used. In making up the complement of stone for each btch, proportional amounts of each aggregate were carefully measured by weight. It was greater uniformity in results. Four batches of each aggregate were made for this test. The resulting average compressive strength per square inch of slab concrete was 2,465.5 lbs. and of trap-rock concrete, 1,975.5 lbs. The slab concrete weighed 140.6 lbs. and the trap-rock concrete 154.5 lbs. per cubic foot.

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

INGLIS' PRODUCTS ARE "MADE IN CANADA"

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Montreal Office: Room 509 Canadian Express Building
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Canada Wire & Cable Co., Limited

Head Office and Works, TORONTO

Bare and Insulated Electrical Wires for all purposes.

Electric Railway Trolley Wire and Feeder Cable.

Sales Offices and Branch Warehouses:

401 Lake of the Woods Building, MONTREAL.
150 Princess Street, WINNIPEG.
Macdonald Marpole Co., Ltd., 427 Seymour St., VANCOUVER.
Canada West Electric, Ltd., REGINA and EDMONTON.
Northwestern Engineering & Construction Company, Limited, CALGARY.

Prompt shipments from Factory or nearest warehouse.

RIVETED TANKS
RIVETED PIPES
PONTOONS

and other similar works

Manufactured by

Canadian Stewart Co., Limited
TORONTO

BITUNAMEL

Unsurpassed for waterproofing foundations and preventing rust and corrosion on exposed iron and metal work.

WRITE FOR SAMPLE

The Ault & Wiborg Co. of Canada Ltd., Varnish Works

Montreal TORONTO Winnipeg

STRUCTURAL STEEL FOR QUICK DELIVERY

We carry in stock at Montreal 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

Bridges, Roof Trusses, Columns, Girders, Beams, Towers and Tanks, Penstock.

Estimates furnished promptly, Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
Main Office and Works, Montreal

Do You Want Crushed Stone?

That is Clean, Tough Stone of a Quality suitable for Macadam Road and Concrete

We can supply you in any size or quantity.
Our service is unexcelled and our prices right.

Phone or write us for quotations when you are in the market.

Office–M 4515—M 4516 Residence—P 2278

Crushed Stone Limited
47 Yonge St. Arcade, Toronto
G. W. Essery, Manager

"AMERICAN"
ENAMELED BRICK

used for prominent and representative buildings of every character.

Their INDIVIDUALITY, DISTINCTIVENESS and BEAUTY make them especially adaptable for exterior use.

Write for information.

AMERICAN ENAMELED BRICK & TILE COMPANY
1182 Broadway, New York.

KAHN CURB BARS

The scientific, practical, efficient and economical protection for edges of concrete curbs, columns, walls, entrance posts, platforms

Write for Highway pamphlet describing Curb Bar and also Armour Plates.

Straight or Curved Bars

Unit of Plate and Anchorage. Substantial Steel Protection. Rigid, Positive Anchorage. No Splitting of Concrete Easy to handle and install.

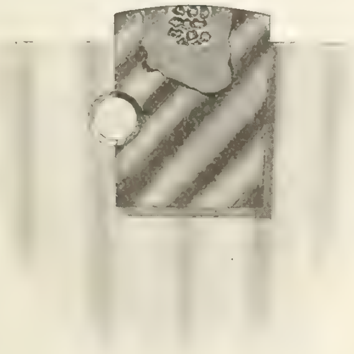
KAHN SYSTEM Building Products

TRUSSED CONCRETE STEEL CO. OF CANADA, LIMITED, Walkerville, Ont.

Save 50%

on

Stone Sawing



Anderson
"Diamond Reinforced"
Saw Tooth

After costly experimenting, we have produced a Saw Tooth which enables diamond saw owners to reduce their cutting (independent of labour) by 50 per cent.

This Tooth is the "ANDERSON REINFORCED DIAMOND SAW TOOTH."

This Tooth contains, instead of one solid diamond, a number of small pieces making up the same weight. The double advantage being that it COSTS LESS and LASTS LONGER.

With the Reinforced Diamond Tooth the diamond is inserted in a broken condition, and perfectly reinforced with steel. As the tooth wears down only small pieces can go to waste, mere dust, and it is impossible for them to suffer loss through entire or partial breakage so common with teeth cutting the harder building stones.

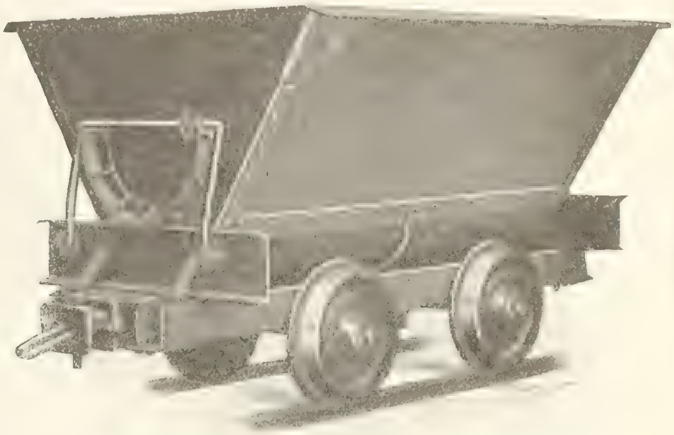
When the first layer of the small pieces have done their work and are worn away, the second layer comes into cutting action, and so on, until the teeth are worn out.

Write us for prices.

Geo. Anderson & Co.
of Canada Limited
QUEBEC BANK BUILDING,
MONTREAL

Steel Dump Cars

Any Size or Design
Workmanship Guaranteed
Prompt Delivery Prices Moderate



(Car Dumps Either Side)

Let us Quote on Your Requirements.

Marsh & Henthorn, Limited
Belleville, Ontario

Goold, Shapley & Muir Co.
Limited
Brantford Winnipeg Regina Calgary

Towers and Tanks for all purposes.

Concrete Mixers

Gas and Gasoline Engines

Hoists

Windmills

Water supply outfits of every description.
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The **HAMILTON BRIDGE WORKS** Co.
Limited
HAMILTON, CANADA

STEEL BRIDGES

FOR STEAM RAILWAYS,
ELECTRIC RAILWAYS
HIGHWAYS, ETC., ETC.

AND BUILDINGS

FOR FACTORIES, OFFICES, WAREHOUSES
POWER STATIONS, MILL BUILDINGS
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ANNUAL CAPACITY 36,000 TONS, Shop "A" 18,000 Tons, Shop "B" 6,000 Tons, Shop "C" 12,000 Tons
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"Hammer Brand"
Hard Wall Plaster

HARD-WALL PLASTER
HAMMER
BRAND
HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

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Hillsborough, New Brunswick, Canada

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RANSOME
Drifting Sand Filters

THIS system has been accepted by the City of Toronto after a thorough test, and a plant having a daily capacity of 60 million imperial gallons is now under construction. The filters can be installed in either the gravity or pressure systems.

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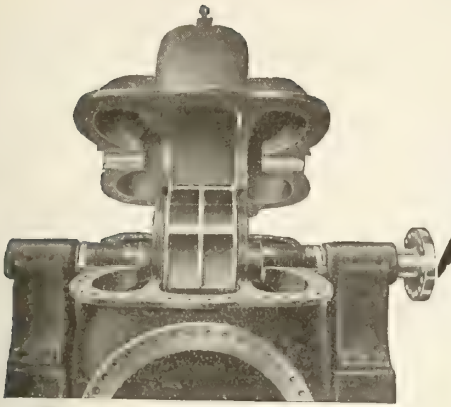

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This photograph shows a De Laval Steam Turbine driven Centrifugal Pump of one hundred million gallons daily capacity. All working parts are at once accessible upon lifting the casing cover and may be taken out after removing the bearing caps. All parts subject to wear, are made to limit gauges and are quickly renewable at small expense. Contrast this with the labor and expense involved in overhauling a reciprocating pump, with its numerous valves, packings, sliding surfaces, etc.

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Send us your blue prints for estimates.

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COATED AND WRAPPED

Made in sizes from 2″ to 10″ inside diameter with different thicknesses for varying pressures.

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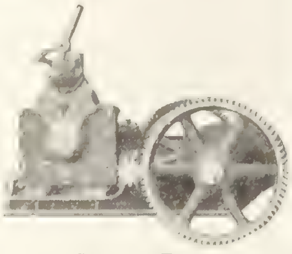

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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

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Specify and get the best Canadian Stone.

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Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

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Woodhouse Chain Co., Trenton, N. J.

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Build up Canada—Now is the time!

Every dollar sent out of the Empire makes us all that much poorer. You can play a big part in supporting the Empire by using only Canadian or British-made building materials.

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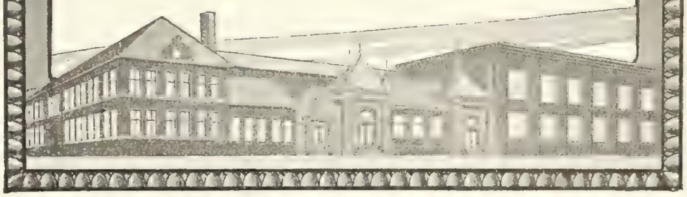

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Prompt shipments.

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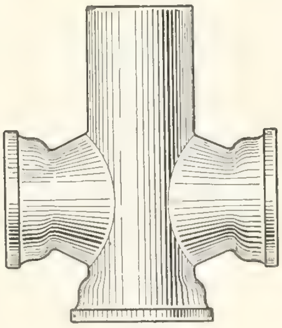

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $21; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22; No. 2 Hemlock, dimension and 1 in., $19 to $21.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $42; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $27; No. 1 pine decking D 2 S, $28; spruce decking, $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casin, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $3.40 to $4.50; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.40; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $4.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto proces (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.5d to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 81c. per gal of 9 lbs.

Raw linseed oil—in bbls., 78c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bbls., 73c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.50; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $3.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.60; 28 gauge, $3.25 per sq. yd. net cash. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.85 per 100 lbs.; Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14½c basis per pound; British manilla, 12½c basis; African hemp, 12½c; sisal rope, 10½c basis; lath yarn, 9¾c. Boiled linseed oil—in barrels, 82½c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles. beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

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WIRE NAILS and other **WIRE PRODUCTS**

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THE
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COMPANY LIMITED
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BRAND

"Pillar Brand"

The Best Gypsum Products

"Pillar Brand" Gypsum Products are made from the highest grade Nova Scotia Rock. Every barrel and bag of "Pillar Brand" products are inspected and tested before shipping. They include

Hardwall Plaster **Cement Plaster** **Land Plaster**
Whitewall Finish **Plaster of Paris**

"Pillar Brand" Hardwall Plaster is mixed only with the highest grade of goat and cattle hair, thoroughly washed and specially prepared. If you need high grade gypsum products—get prices on "Pillar Brand".

Write us.

The Iona Gypsum Co., Limited

Head Office, **Sydney, N. S.** ***Mills,*** **Iona, N. S.**

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls., 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 30 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $25; fire clay, $12 per ton.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $5.35 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

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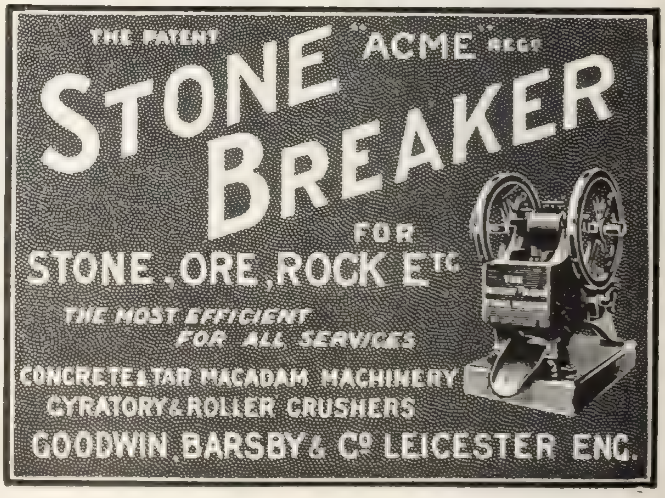
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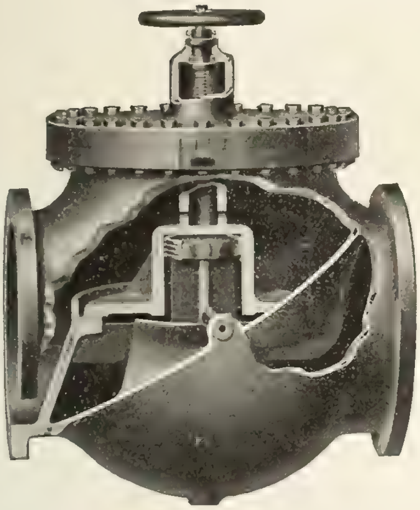

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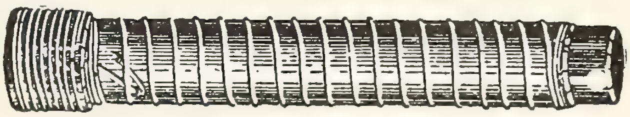

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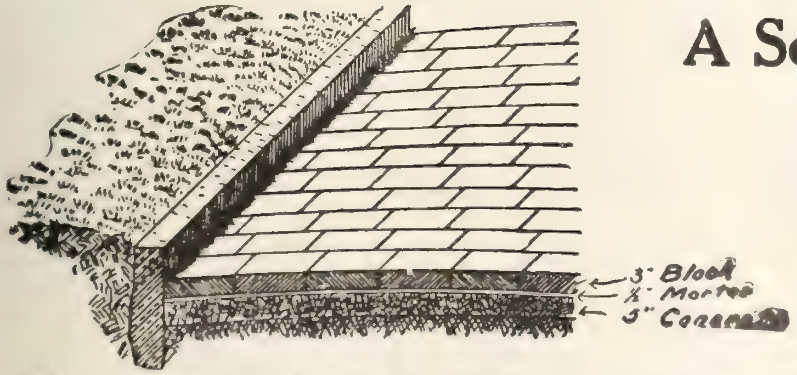

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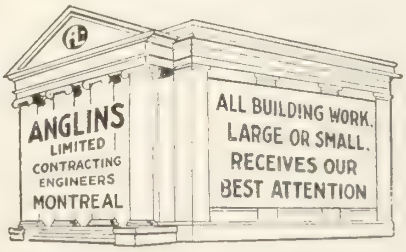

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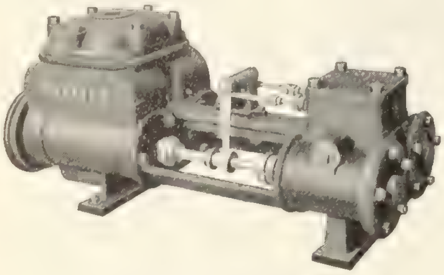

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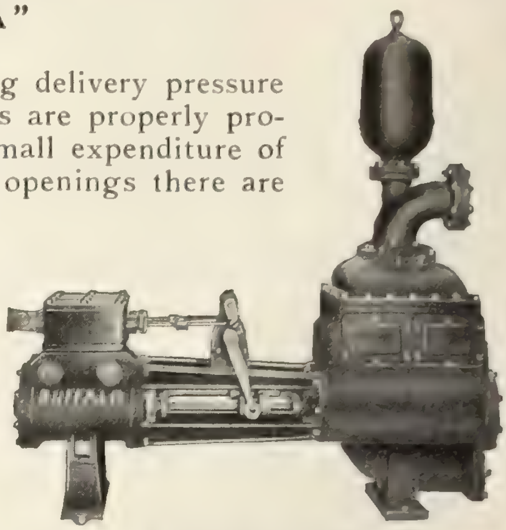

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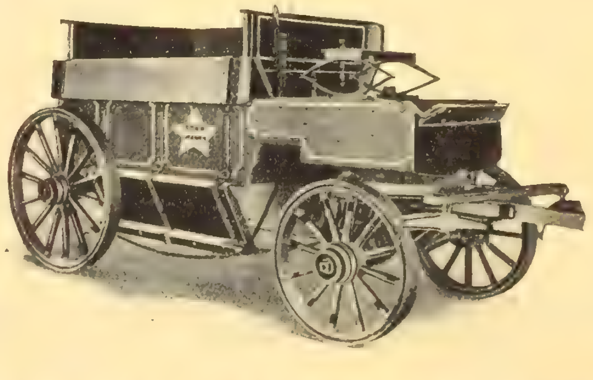

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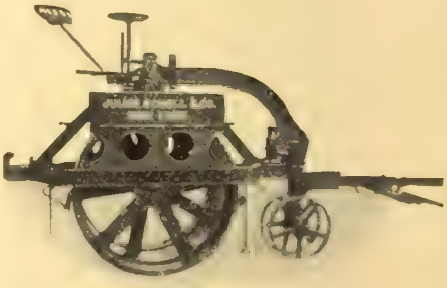

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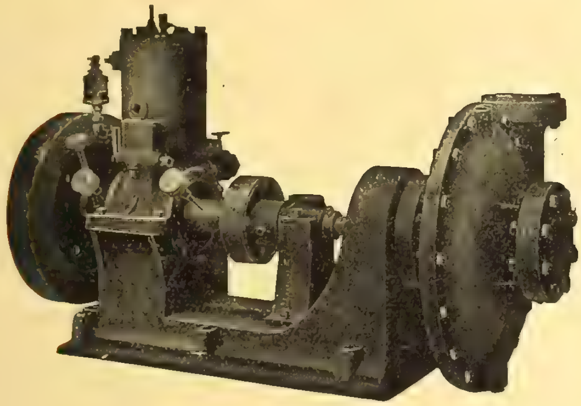

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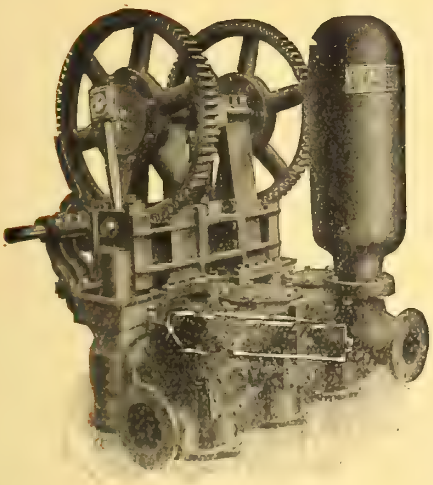

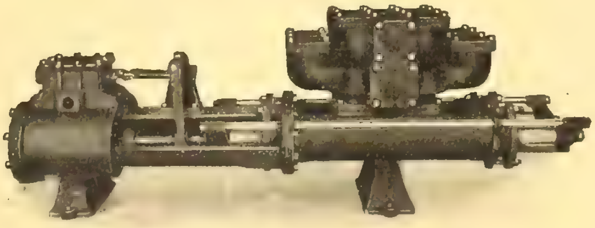

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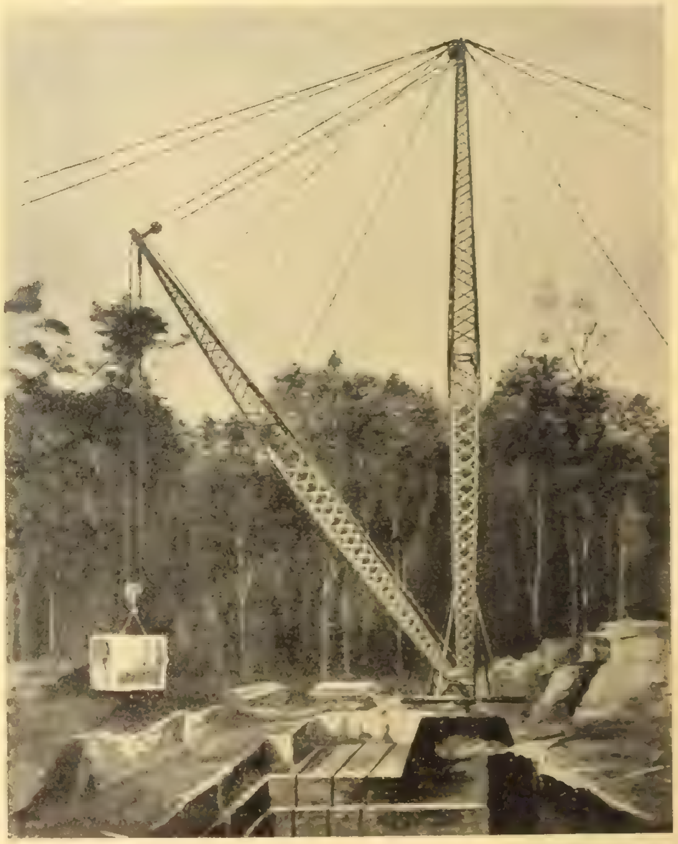

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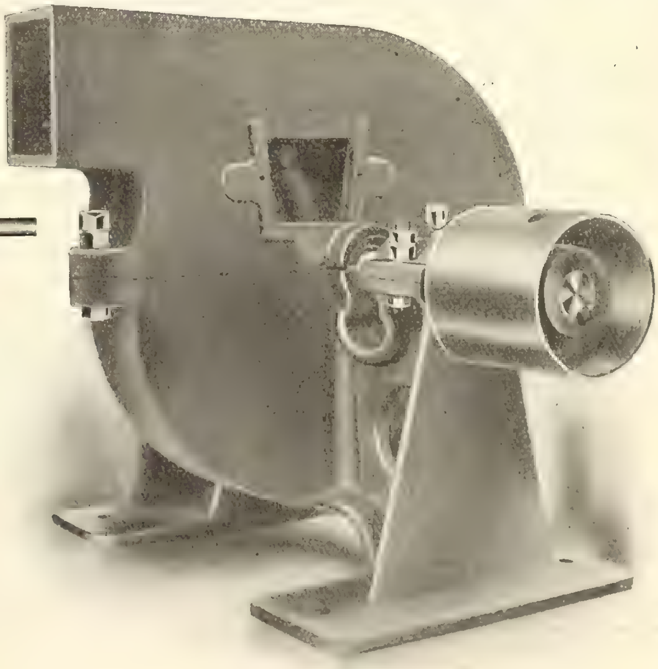

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- Canadian Blower and Forge Co.
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- De Laval Steam Turbine Co.
- E. Laurie Company
- Sheldons Limited
- Sturtevant Co. of Can., Ltd., B. F.
- Turbine Equipment Company

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- Inglis Company, John
- Marsh & Henthorn
- McDougall Caledonian Iron Wks.

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- Bradford Pressed Brick Co.
- Hydraulic Press Brick Co.
- Interprovincial Brick Co.
- Maloney, John.
- North-Western Terra Cotta Co.

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- Canadian Blower and Forge Co.
- Sheldons Limited

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- Browning Company
- Cleaton Company R. E.
- Hopkins & Co., F. H.
- Lecky & Collis
- Manitoba Bridge & Iron Works
- Sudbury Construction & Machinery Company

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- Chicago Bridge & Iron Works
- DesMoines Bridge & Iron Co.
- Dickson Bridge Works
- Dominion Bridge Company
- Hamilton Bridge Works Co.
- Mackinnon-Holmes & Co.
- Manitoba Bridge & Iron Works
- Maritime Bridge Company
- National Bridge Company
- Pittsburgh-DesMoines Steel Co.
- Sarnia Bridge Company
- Structural Steel Company
- Standard Steel Construction Co.

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- Aikenhead Hardware Limited

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- Dominion Wire Rope Co., Ltd.
- Standard Underground Cable Co. of Canada, Limited

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- Trussed Concrete Steel Co.

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- Cast Stone Block & Machine Co.

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- Interprovincial Brick Co.
- Maloney, John.
- Morrison & Co., T. A.
- Rogers Supply Company

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- Hull Iron & Steel Foundries

Cement Guns
- Cement Gun Company

Cement Waterproofing
- Ceresit Waterproofing Co.

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- De Laval Steam Turbine Co.
- E. Laurie Company.
- Turbine Equipment Company

Ceresitol
- Ceresit Waterproofing Co.

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- Turbine Equipment Company

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- Browning Company

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- Goold, Shapley & Muir Co.
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- Lecky & Collis
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- Woodstock Concrete Mach. Co.

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- Conduits Co., Ltd.
- Orpen Conduit Co., Ltd.
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- Lecky & Collis
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- Montreal Locomotive Works
- Railway Contractors Supply Co.
- Stinson-Reeb Builders' Supply Co.
- Sudbury Construction & Machinery Company

Contractors' Flare Lights
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- Goodwin, Barsby & Co.
- Sturtevant Co. of Can., Ltd., B. F.

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- Sarnia Metal Products Company

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- Morris Crane & Hoist Co., Herbert
- Pollard Mfg. Company

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- Canadian Equipment Company
- Crushed Stone, Limited
- Hagersville Contracting Co.
- Smyth & Ryan

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- Goodwin, Barsby & Co.
- Hamilton Mfg. Co., Wm.
- Lecky & Collis
- London Concrete Machinery Co.

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- Browning Company
- Canadian Equipment Company
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- Canadian Ingersoll-Rand Co.
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- Lecky & Collis

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- Canadian Ingersoll-Rand Co.

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- Marsh & Henthorn
- National Steel Car Company
- Sheldons Limited

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- Deere Plow Co., John
- Tiffin Wagon Co.
- Watson Wagon Co.

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Electricians' Plugs
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- Roelofson Elevator Works
- Turnbull Elevator Co.

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- Dull Company, Raymond W.
- Hopkins & Co., F. H.
- Pawling & Harnischfeger

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- Sheldons Limited

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- Canadian Blower and Forge Co.
- Can. Fairbanks-Morse Company.
- Hopkins & Co., F. H.
- Inglis Company, John
- Laurie & Lamb
- McDougall Caledonian Iron Wks.

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- Cape Company, E. G. M.
- Chipman & Power
- Dominion Engineering & Inspection Company
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- Galt Engineering Co., John
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(Continued on page 12)

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for

Water and Gas Supply, Fire Protection, Road Culverts, etc.

30" Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

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DUNDAS QUARRY

Capacity 4000 Tons Daily

OUR

Facilities for supplying any quantity of

CLEAN CRUSHED STONE

Are Unexcelled

SHIPMENTS — G. T. R. & C. P. R.

Team Delivery If Required

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GRANOLITHIC

TRAP-ROCK

Rogers Supply Co., Limited

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MAIN 4155

Fig. C 21. Mantel Clock

ARTISTIC MERIT

as well as accuracy in Time-keeping is embodied in all Pulsynetic Electric Clocks. No matter whether they are to be fixed in the Residence, Office, Factory, Warehouse, or Tower, we have the correct design at the right price.

One master transmitter controls any number of dials, irrespective of size or position and never wants winding.

Architects, Engineers and all interested in Correct Time should send at once for our Book Five, or full particulars and prices may be obtained from:—

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Cables, Lodestone

KERR

Gate Valves

and

Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

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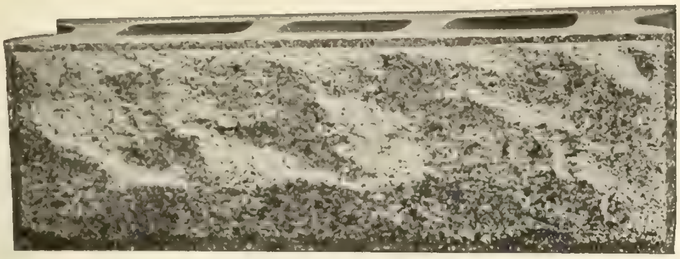
Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO



Molds for Casting
Waterproof Hollow Cement Building Blocks
With Granite Faces

THEY COST LESS — THEY SELL FOR MORE
YOU SELL MORE OF THEM

8 x 8 x 24 inch Granite Rock Face Block

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.

8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited **(Zagelmeyer System)**
298 Howard Avenue, WINDSOR, ONTARIO

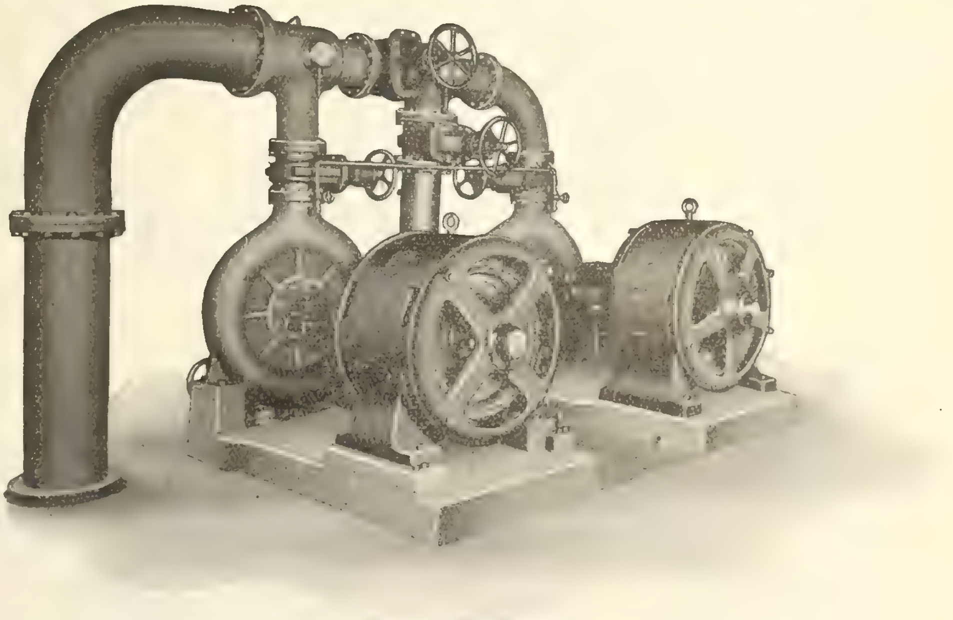
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

from

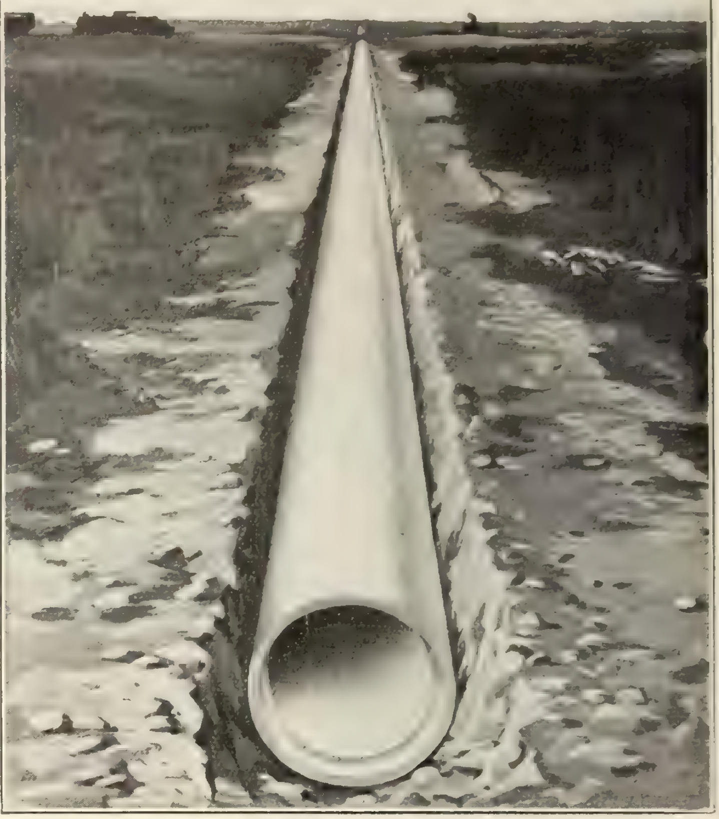
Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.



Turnbull Elevators

Passenger
Freight
Hand Power
Dumb Waiters

The **Turnbull Elevator**
Mfg. Company
TORONTO, ONT.

TRADE MARK

Hull Iron & Steel Foundries, Limited

Head Office and Works - HULL, QUEBEC

Manufacturers of Steel Castings

Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Repair parts for Stone Crushing Plants, Mining Machinery and Cement Mills our specialty.

Machine Moulded Gears

any size up to 18 feet in diameter made without patterns.

We solicit your patronage and prompt attention will be given to any orders.

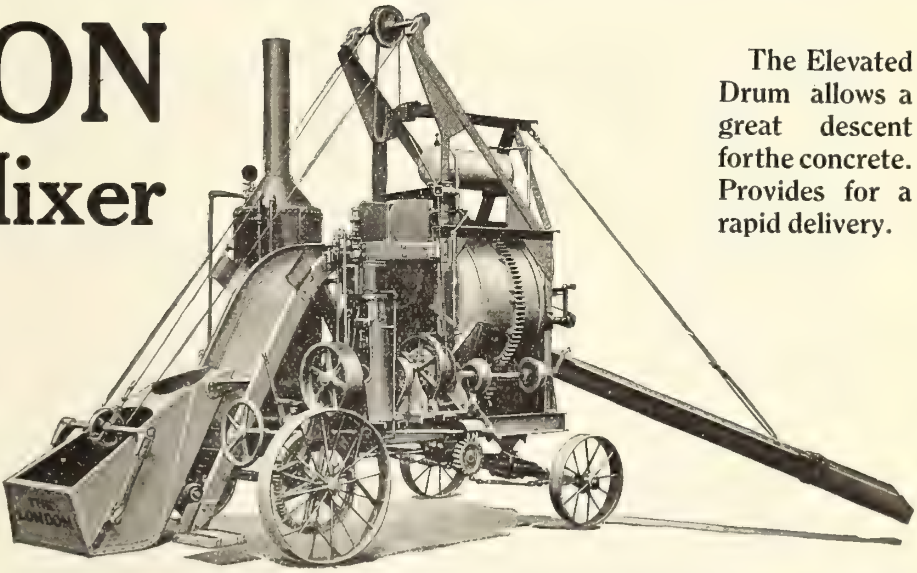
LONDON

Paving Mixer

Forward Loader and Rear Discharge **take up little room on the roadway.**

Traction Drive. Moves anywhere with its own power.

The Rotary Delivery Chute turns in a complete half circle, also opens up at different points. The concrete is distributed to any part of the road **No wheeling. No shovelling of concrete.**



The Elevated Drum allows a great descent for the concrete. Provides for a rapid delivery.

ONE-THIRD LESS MEN REQUIRED. A BETTER JOB. We guarantee that this Machine will deliver Concrete on a roadway at a saving of 10 per cent over any other type of Machine. Full particulars on request. Send for Catalogue No. 1A.

We have twenty-three different sizes and styles of Mixers.
Also a full line of Concrete Machinery and Cement Working Tools.

THE LONDON CONCRETE MACHINERY CO., LTD.
LONDON, ONTARIO
Branches and Agencies in every large City in Canada
World's Largest Manufacturers of Concrete Machinery and Cement Working Tools

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Hope & Sons, Henry
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Trussed Concrete Steel Co.

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Ceresit Waterproofing Co.

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Can. Consolidated Rubber Co.

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Toronto Furnace & Crematory Company

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Lecky & Collis

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Peerless Form Clamp Co.

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Goold, Shapley & Muir Co.
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De Laval Steam Turbine Co.

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Luxfer Prism Company
Pilkington Bros.
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Gillis & Geoghegan
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Lecky & Collis
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Marsh & Henthorn
Morris Hoist & Crane Co., Herbert
Pollard Mfg. Company.
Pawling & Harnischfeger.

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Hopkins & Co., F. H.
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Noble, C. W.
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Steel & Radiation Ltd.
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Metallic Roofing
Pedlar People Limited

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Gartshore-Thompson Pipe Co.
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Warren Foundry & Machine Co.

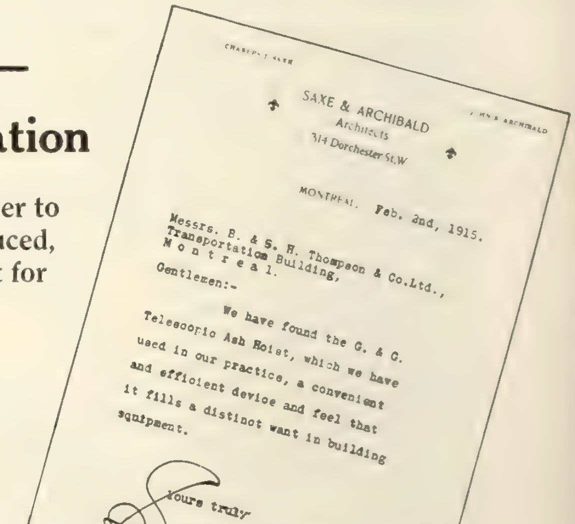
(Continued on Page 14)

SAUVEGARDE BUILDING
MONTREAL

In Montreal alone, a number of the most prominent buildings are equipped with the G & G Telescopic Hoist

Another Letter—
And Another Installation

Messrs. Saxe & Archibald whose letter to our Montreal agents is here reproduced, specified the G & G Telescopic Hoist for the La Sauvegarde Building.



CHARLES J. SAXE
SAXE & ARCHIBALD
Architects
314 Dorchester St. W
JOHN S. ARCHIBALD

MONTREAL, Feb. 2nd, 1915.

Messrs. B. & S. H. Thompson & Co. Ltd.,
Transportation Building,
M o n t r e a l.

Gentlemen:-

We have found the G. & G. Telescopic Ash Hoist, which we have used in our practice, a convenient and efficient device and feel that it fills a distinct want in building equipment.

Yours truly
Saxe & Archibald

The G&G PATENTED Telescopic Hoist
with compound gear and brake attachment

Raises a maximum load of 500 lbs. at a speed of 30 feet per minute, operated from sidewalk. Clean, safe and **noiseless** in operation.
Only ash hoist with which it is practical for one man to perform entire removal of ashes.

"Made in Canada"

Write to nearest agent for illustrated Booklet and Prices

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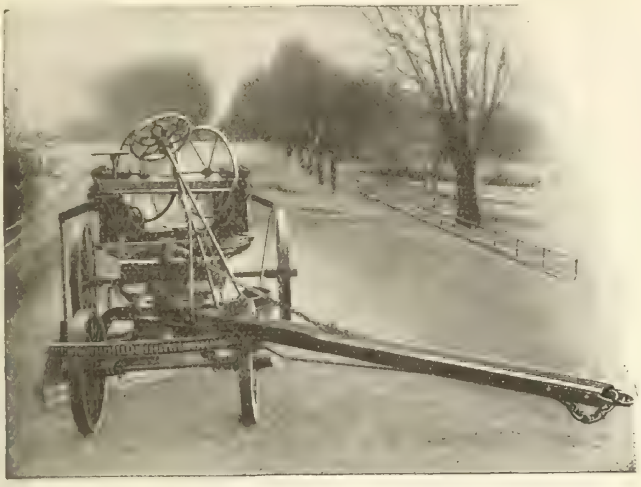
Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

W. T. Grose, Agent for Manitoba, Saskatchewan, Alberta, **Winnipeg**

"MADE IN CANADA"



The CHAMPION Lever Road Drag is conceded by users in all parts of the country to be the most complete road drag made. It is simple, durable, capable and easily operated. We offer it as a road drag that will not fail to meet the approval of the most exacting user.

Champion Road and Contractors Outfits
A complete and varied line of all machines for
Road Building and Street Work

Manufactured by
American Road Machine Company of Canada, Limited
GODERICH, ONTARIO

TRADE **CHAMPION** MARK

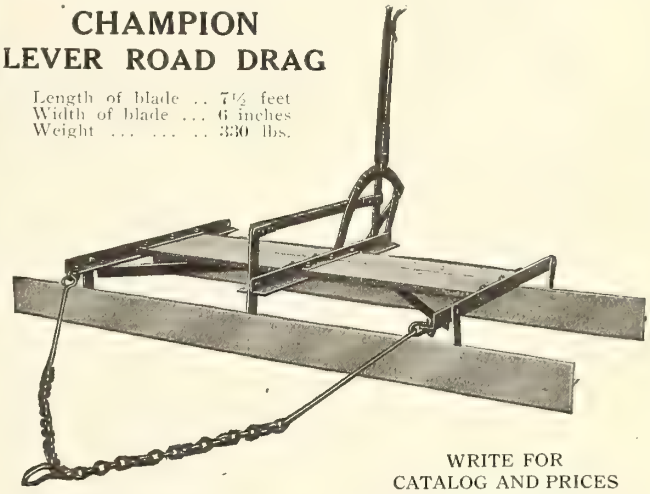
CHAMPION
OFF-SET GRADER TONGUE

This is a most important appliance for use with any grader, and is especially desirable where traction engine or other power is used for operating the Grader. Ditching is a much easier operation with the use of these off-set tongues, as it allows the teams, engine or other power to use the middle of the road at all times while the Grader may be off side either to right or left of road

The operator on driver's seat has full control at all times and can bring the machine into line with the teams or engine whenever desired.

CHAMPION
LEVER ROAD DRAG

Length of blade .. 7½ feet
Width of blade ... 6 inches
Weight ... . 330 lbs.



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CATALOG AND PRICES

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Sturtevant Co. of Can. Ltd., B. F.

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- Britnell & Company
- Can. H. W. Johns-Manville Co., Ltd.

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- Canadian Ingersoll-Rand

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- Inglis Company, John

Pressed Brick
- Interprovincial Brick Co.

Pump Valves
- Can. Consolidated Rubber Co.

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- Canadian Blower and Forge Co.
- Canadian Fairbanks-Morse Co.
- Canadian Ingersoll-Rand Co.
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- De Laval Steam Turbine Co.
- Hamilton Mfg. Co., Wm.
- Hopkins & Co., F. H.
- Inglis Company, John
- Laurie Company, E.
- McDougall Caledonian Iron Wks.
- Morris Machine Works
- Smart-Turner Machine Co.
- Turbine Equipment Company

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- Lecky & Collis
- George Anderson & Co.
- Goodwin, Barsby & Company

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- Hopkins & Co., F. H.
- Lecky & Collis

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- Burlington Steel Company
- Canada Wire & Iron Goods Co
- Dominion Iron & Steel Co.
- Pedlar People Limited
- Steel & Radiation Ltd.
- Trussed Concrete Steel Co.

Road Machinery
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- Exeter Mfg. Co., Ltd.
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- Lecky & Collis
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- Pedlar People Limited

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- Can. Consolidated Rubber Co.

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- Can. Fairbanks-Morse Company.
- Taylor, J. & J.

Scales
- Can. Fairbanks-Morse Company.

Screens
- American Road Machine Company of Canada
- Canada Wire & Iron Goods Co.
- Dull Company, Raymond W.
- Goodwin, Barsby & Company

Sewer Pipe
- Britnell & Company
- Canada Iron Corporation
- Dominion Sewer Pipe Co.
- Gartshore Thomson Pipe Co.
- London Concrete Machinery Co.
- National Iron Works
- Ontario Sewer Pipe Co.
- Smyth & Ryan
- Standard Clay Products Ltd.

Sewer Trenching
- Lecky & Collis

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- Bishopric Wall Board Co.

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- Beatty & Sons, M.
- Canadian Equipment Company
- Hopkins & Co., F. H.
- Montreal Locomotive Works

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- London Concrete Machinery Co.

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- Pedlar People Limited

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- Chicago Bridge & Iron Works
- DesMoines Bridge & Iron Co.
- Hamilton Mfg. Co., Wm.
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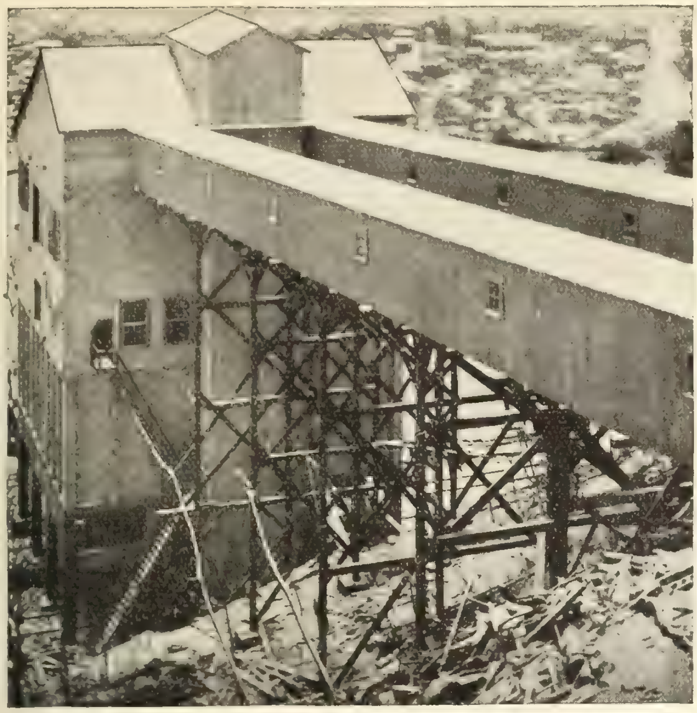

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The Premier Road Dressing and Binder

"FLUXPHALTE" is a heavy road oil containing 80% of solid pure bitumen combined with sufficient liquid bitumen to bring it to a proper consistency for road dressing. It is absolutely free from greasy oils.

This asphalt macadam binder which we are introducing into Canada has stood the test of time and is offered to the municipalities of the Dominion with the highest recommendations of critical road engineers in Great Britain.

Today the heavy traffic on roads has found the old water-bound macadam unsuitable, and in order to provide a binder and dust-layer which will stand up under these new conditions, "FLUXPHALTE" has been placed on the Canadian market

"FLUXPHALTE" is as easily applied as any binder and gives far better results

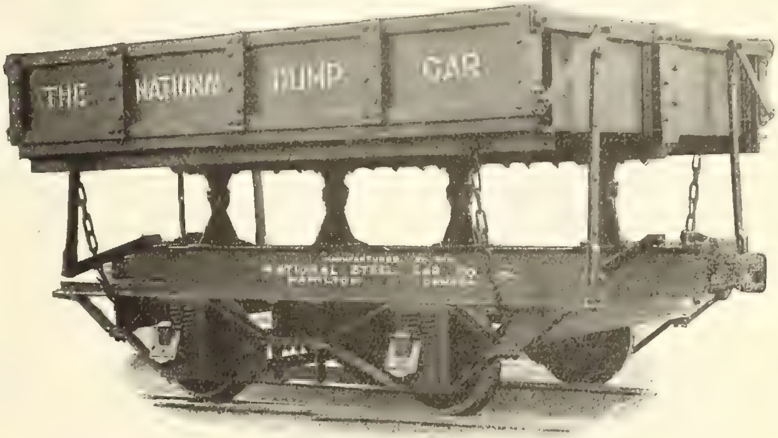
Write for copy of our New Booklet.

The Asphalt and Supply Company, Limited
103-107 Board of Trade Bldg. - - MONTREAL

Why Pay Duty On Dump Cars?

"National"

"Made in Canada"



The success of Canada's war for commercial victory depends upon her citizens and where they buy. Not only from a patriotic standpoint, but as a sound business question we say "Why pay duty on Dump Cars?" The "National," Made-in-Canada car is equalled by few cars and excelled by none, either foreign or domestic. We invite a detailed comparison of the "National" with other leading makes.

The "National" hand dump car is made in all sizes up to 8 yards. Larger capacities are air dumped.

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Head Sills, Shoddy, Stone Sawing.

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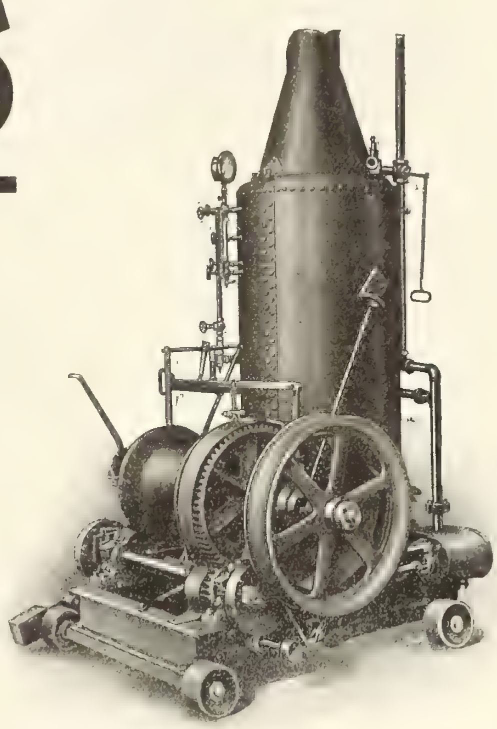

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- Mine Hoists
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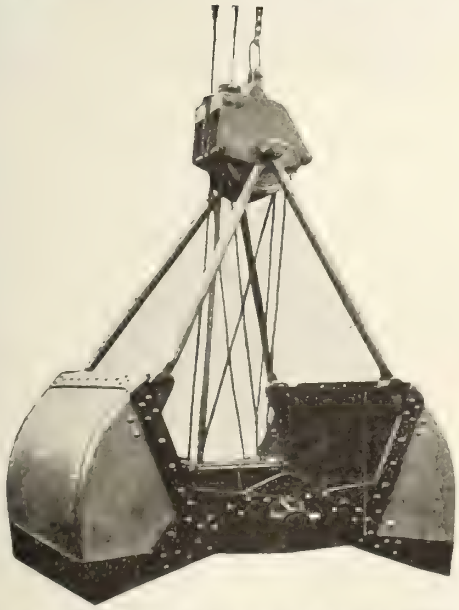

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Toronto Montreal Winnipeg Calgary

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Salt Glazed and Vitrified

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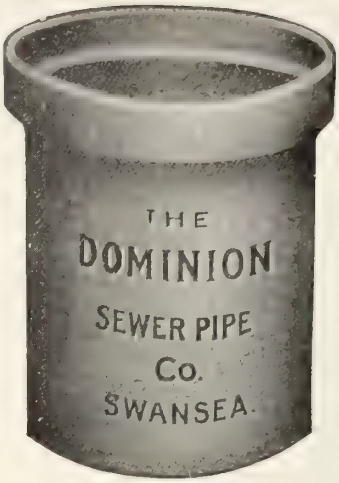

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Impervious to Water.

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Culvert Pipe
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(The Independent Co.) Limited
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COATED AND WRAPPED

Made in sizes from 2″ to 10″ inside diameter with different thicknesses for varying pressures.

PAGE-HERSEY
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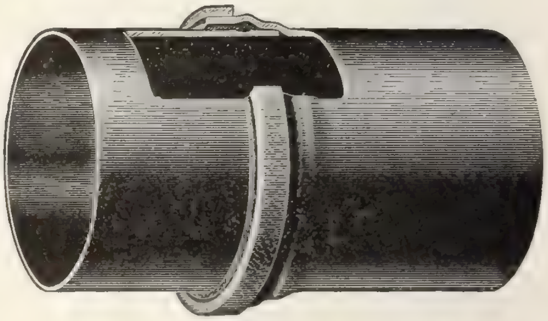

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The Chemical Analysis of

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offsets the excess thickness of cast iron

Quick Shipment

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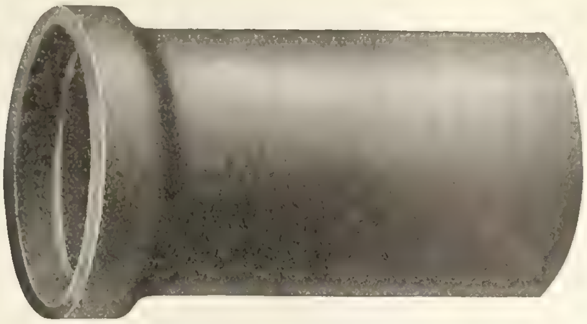

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In our salt glazed vitrified sewer pipe we offer the highest type of sewer material. Pipe of our manufacture have been used in practically every city in Canada. Highly glazed and perfectly vitrified.

If you are contemplating sewer construction we can quote you some attractive prices. We also make all classes of fire clay goods.

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Made in Canada with Canadian Clay, Canadian Coal, and by Canadian Workmen.

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For Sewers over 24 inches
Ask for particulars of this new idea.

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And Save Money To Ratepayers

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You can save 20% to 30% of normal cost by building your sewers now. The extra ½% or 1% that money costs is swallowed up by the saving on work.

—Buy Now—

and keep the wheels of progress turning.

The Ontario Sewer Pipe Company, Limited

MIMICO, - ONT.

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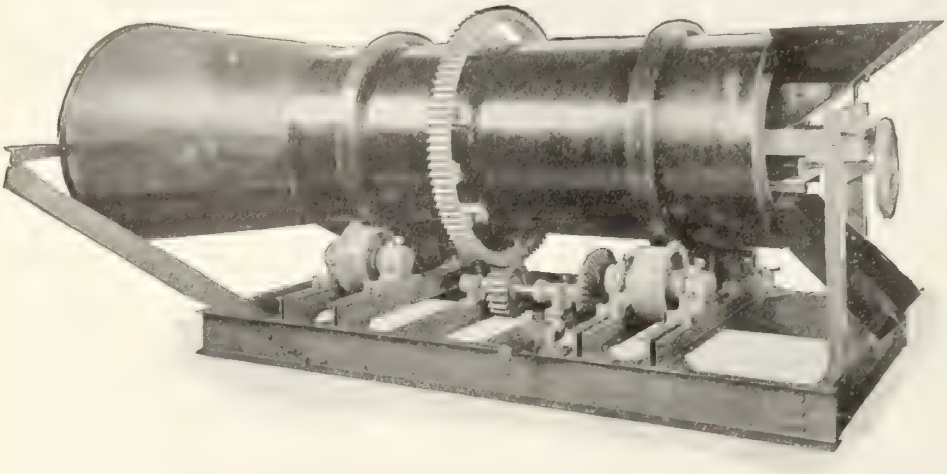

Good concrete requires clean sand and gravel. The use of the Dull washer enables you to wash concrete materials right on the job. It protects you from loss due to failures on rejections due to the use of too dirty material. It reduces the cost of concrete work and increases your profits.

Contractors can use a Dull Washer to good advantage.

Write us for our washer bulletin.

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Both Literally and Practically

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Install "Luxfer" in any dark building where daylight is wanted and you get daylight thrown where you want lots of it every day and all day long without any cost after the initial outlay.

The Luxfer Prism was the first and best prism on the market and despite its competitors who have come and gone, "Luxfer" is still supreme.

Always specify Luxfer and you will always get daylight.

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MADE IN CANADA

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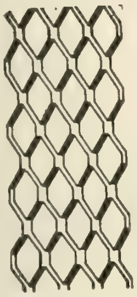
Contractors, Builders and Architects have come to recognize the advantages and economy of using Metal Lath in preference to wood in buildings of modern construction. The Victory of Metal over wood is clearly demonstrated in

Pedlar's "Perfect" Expanded Metal Lath



It is Fireproof—the Key is positive, the actual size of the mesh being only ⅜ in. x ½ in., and when the plaster is applied to our "Perfect" Metal Lath, the latter becomes practically embedded in the mortar, making it impossible for the mortar to crack or fall off.
"Perfect" Metal Lath can be applied more quickly than wooden lath, each sheet being 24 in. x 96 in., covering 1 7-9 square yards, and requiring only 36 staples to be driven. It takes no more mortar than wood lath, and there is no possibility of annoyance from sap staining through the plaster, as is often the case with wood.

Write for Lath Booklet "L.C.R."

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THE PEDLAR PEOPLE, Limited
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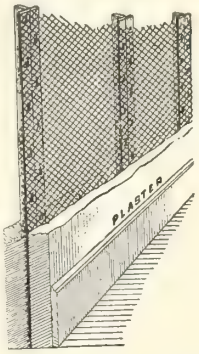

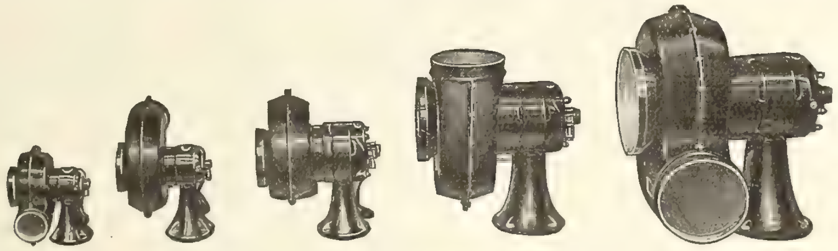

Fans for the Hot Weather

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Sturtevant
(REG. CAN. PAT. OFF.)

Ready-to-Run Portable Ventilating Sets

will supply abundant fresh air—will exhaust foul air, fumes, smoke or odors. They are also used for blowing, cooling and other industrial purposes.

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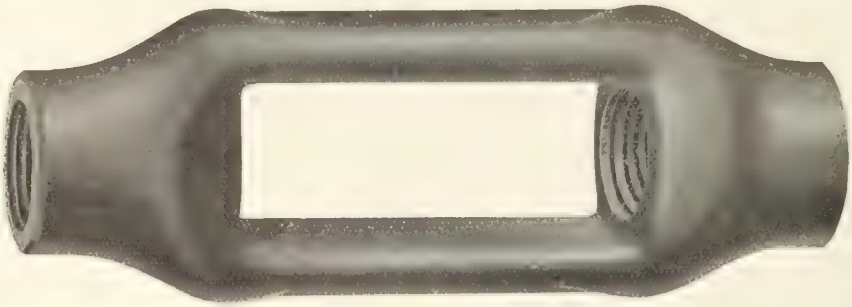
Standard Turnbuckles

Made in Canada

All Sizes in Stock



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Limited
Welland, Ontario

"Gunite" Protects Wooden Piles

The government of Porto Rico had some piles to drive for wharf construction. The contractor on the job, after using "Gunite" coated piles wrote as follows:—

The work has been accomplished in a most satisfactory manner by using your gun.

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A thickness of 1 in. or 1¼ in. "Gunite" is obviously all that is necessary to protect timber from Teredos, Limnoria and other wood-destroying insects.

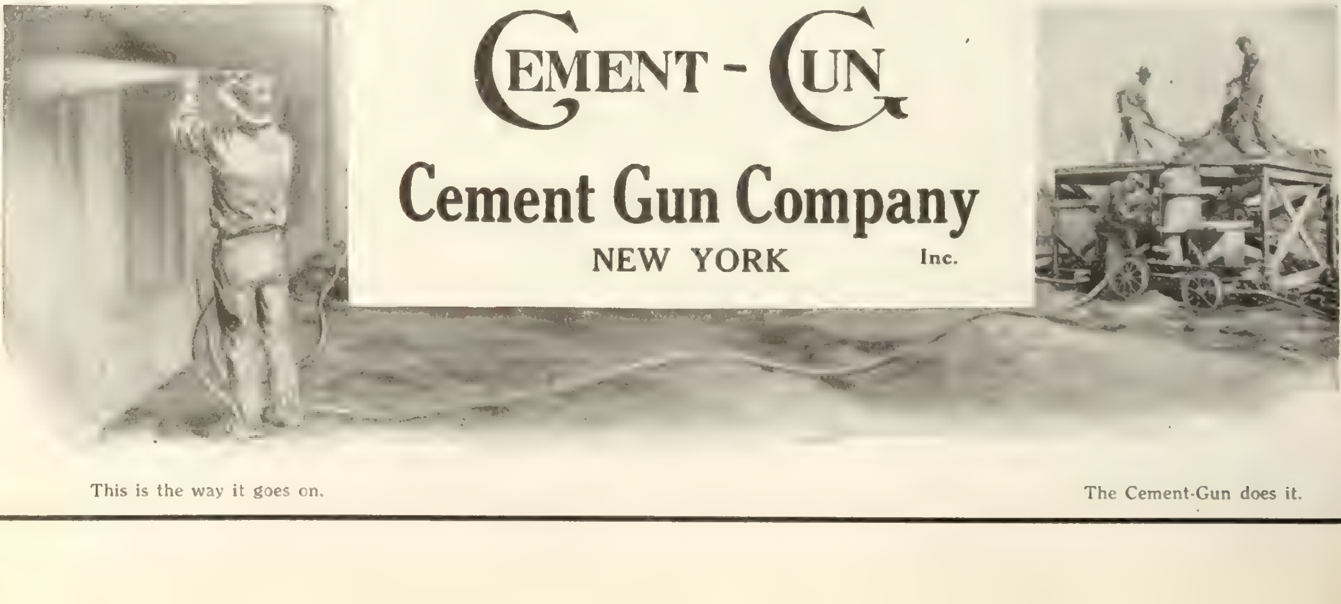
The cost of Gunite-Coated Piles is less than that of creosoted piles—the results are more satisfactory.

Gunite-Coated piles are permanent.

Write for illustrated booklet on the

CEMENT - GUN

Cement Gun Company
NEW YORK Inc.



This is the way it goes on.

The Cement-Gun does it.

ESTABLISHED 1886

Contract Record and Engineering Review

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The Part of the Governments in Leading Constructional Enterprise

DURING the last few months we have adduced many arguments in favor of the idea of undertaking construction now, at a time when everything is on the side of the man with money to spend, when the country's greatest need is employment and activity, when every enterprise showing constructional purpose exerts an encouraging influence upon the community, when labor is so plentiful that one can discriminate at will, when the prospective builder has the whip-hand in negotiating for building sites, when the materials of construction are obtainable at rock-bottom prices, and contractors have reduced the art of estimating to an exact science. Many there have been who have concurred in these views, but it has remained for Mr. James McDiarmid, of Winnipeg, to find the exact balance.

Mr. McDiarmid, whose letter is published in this issue, writes commenting upon the letter by Mr. W. A. Mountstephen, of London, England, published in our last issue. He tells us of the situation in the West—how many of the towns and cities have been developed two years ahead of their requirements. He reminds us that business and philanthropy are a bad mix, and that the capitalist cannot be expected to build pro bono publico. He makes a forceful plea for the provision of employment, and for the promotion of business enterprise by way of governmental enterprise. He suggests the construction of public buildings and the undertaking of comprehensive highway schemes.

To these views The Contract Record subscribes unreservedly. Months ago we urged that the Provincial and Federal Governments should take a more active part in maintaining the general business stability of the country. In a series of editorial articles we pointed out the part that the authorities could take in placing highway construction and the erection of public buildings and other such undertakings under way at a time when the depression caused by this great world war was having such telling effect. The suggestion now revived by Mr. McDiarmid received particular emphasis in our issue of December 16th, when, in commenting editorially upon the Central Technical School (described in the above issue), we observed:

> "In this magnificent building, erected at a cost of some two million dollars, Toronto has a standing monument to progressiveness, and material proof of an understanding of present-day requirements. The example is one which may well be followed, particularly in Western Canada, where the facilities for technical education are so lamentably few. At this very time, when business conditions are quiet, funds are hard to obtain, and building work is slackening, an impetus to the activities of many a community throughout the country might be given by the technical school movement. The erection of a building on the Toronto scale would not have to be considered in many cases, and in some instances the expenditure might even be reduced by a couple of ciphers. Funds may be scarce, but money is always obtainable for sound, legitimate projects that have substantial backing, and contracts for such buildings could not be awarded at a better time than the present. The employment which these undertakings would provide for the working classes would be a Godsend to the country."

It must not be taken for one moment that we are disclaiming the "Build-Now" policy: we are heart and soul with those who advocate building now; but we are not altogether in sympathy with those who contend, illogically, that a wholesale investment in general building will pay at such a time as the present, and this point is well taken by Mr. McDiarmid. If it were possible to induce speculators and men with capital to start building operations on anything like an appreciable scale, it would not be long before we should find the country loaded down with failures. The constructional interests can only expect a degree of the success or failure which attends the undertakings with which they are identified.

One is not justified in going further than presenting—logically, clearly, forcefully—the best arguments—enduring arguments—as to how and why a man should spend his money. One may cry from the housetops that the factory owner, the hotel proprietor, the dweller in the city and the town, the artisan—all these and others, provided they have the money available—can build now with profit and patriotism; but one must retire into an obscure corner to suggest to any thinking community that anything like lavish expenditures—building, municipal or otherwise—are warranted or advisable.

Mr. McDiarmid's suggestion of "a public highway from the Atlantic to the Pacific" has much to commend it. Thanks to the efforts of the B. C. Highway Commission, a start has already been made upon such a project at the British Columbia end. Now is the time for such an undertaking to be prosecuted; now is the time for the Dominion Government to take the lead in authorizing reasonable expenditures on this and other legitimate public works. Such undertakings could not fail to be well received by the country at the present time, and they would redound to the advantage of all later on.

LETTERS

"The West Must Look to the Government"

Winnipeg, May 28th, 1915.

Editor, The Contract Record:

While I agree in part with the arguments adduced by Mr. W. A. Mountstephen in the letter published in your last issue, I cannot help thinking that the "Build-Now" idea can provide only a partial solution to the great problem of the unemployed in the western provinces. One unbiassed by personal considerations must feel that the advantage of cheap building material has not been greatly in evidence so far.

A general "Build-Now" policy has little in its favour as a business proposition. A man with capital to place is not expected to be a philanthropist; he expects a fair rate of interest, and that interest promptly paid, besides having a reasonable security for his investment. No one has a stronger belief in the future of this country than I, but I cannot see how an investment in general building will pay at this time.

Whatever the causes which led up to the present state of affairs, it is quite plain to any one who is willing to look conditions squarely in the face that all these western cities have been over-built—some of them are at least two years ahead of requirements. There is an unusual amount of vacant property—offices, stores, and dwellings—and consequently the revenues from building investments are greatly decreased. Of course, ours is a new country, and a year or two cannot fail to see conditions normal again. But why advocate the "Build-Now" policy when such a line of action can only make matters worse? The only sane reason for advocating the "Build-Now" idea is the necessity of providing work for the unemployed—and this is a matter for the Government, not for the investor.

What might be done to help present conditions is to put in hand the many public works necessary to the development of the country. Many public buildings are needed; and there is the construction of a public highway from the Atlantic to the Pacific, besides many other works of a public nature. Pressure should be brought on the Governments so that the authorities might take the lead in this important matter.

Owing to local causes and the absence of manufacturing industries, the western provinces cannot take advantage of any of the activities arising out of the war. The West, then, must look to the Government.

Yours truly,
JAMES McDIARMID.

A test of the efficiency of bituminous carpets for concrete roads was one of the purposes of the Byberry and Bensalem Service Test Road constructed by the Philadelphia Department of Highways. The results of about two years' service on ten areas of this carpeted concrete are recorded in the annual report of the department for 1914. As summarized by Engineering and Contracting, the bituminous covering on five of these areas has practically disappeared; on two it is in fair condition, and on three it is in good condition. No definite analysis in detail is practicable from the published records; but it is plain that all carpetings are not a success, nor are all carpetings a failure. This is information of at least corrective value. There has been observable a rather strong tendency of road engineers to group themselves into two parties, one seeing no value in bituminous carpets and one advocating their use always. Obviously from the Philadelphia tests the value of carpeting a concrete road depends upon the carpet. The immediate duty of road builders then is to determine as far as may be practicable the kinds of bituminous surfacings that are most effective and the degree of their efficiency. Until these facts are available it is hardly logical to assume a partisan stand either of approval or of disapproval.

Hypochlorite in the Milwaukee water supply causes trouble from tastes and odors when applied in sufficient quantity to eliminate gas-forming bacteria and when the temperature falls below 38 deg. Fahr. In his annual report H. P. Bohmann, Superintendent of Waterworks, states that in spite of reducing the rate to 2.3 lb. per million gallons, trouble occurred. The average efficiency of the chemical in eliminating bacteria was 96.56 per cent. B. coli were present in the raw water on 189 days in 1 cu. cm. and on 270 days in 10 cu. cm. In the treated water the corresponding figures are 3 days in 1 cu. cm. and 48 days in 10 cu. cm. The average number of bacteria per cubic centimeter on gelatine in the treated water was 94, with a maximum of 2,000 and minimum of 0. Corresponding figures for the raw water are 2,590, 14,200 and 80.

Water consumed in Milwaukee per capita during 1914 averaged 110.2 gals., a reduction of 1.3 gals. over the previous year. Because of the large number of manufacturing establishments it is practically impossible, according to the last annual report of the waterworks department, to expect a much lower consumption.

Cutting Costs on Road Work by the Use of Industrial Equipment

IN the Illinois Highway Bulletin for April, Mr. F. Tarrant, Division Engineer of the Illinois Highway Department, describes how the Department have operated industrial railway equipment on the highway work of the State. In building country roads they have made the maximum possible use of this equipment, but by the method of using they have kept down the cost to the lowest possible point. The equipment used in the construction of a 12.5-mile water-bound macadam road 10 ft. wide consisted of two 20 h.p. locomotives, 6 miles of portable track and sixty cars. The rails and ties were made up into 15-ft. sections, each section weighing 225 lbs., and capable of being handled by two men. The switch and curved sections were in 15-ft. lengths also, and were easily and quickly fitted into the main track in case a switch or turnout was desired. The steel ties and angle joints were all bolted securely.

Two flat cars were received for use in hauling steel, but Mr. Tarrant found that better results could be obtained by removing the beds from the stone cars and hanging sixteen or eighteen sections on each truck, coupling them together by a 6-ft. pole. Later, when the entire equipment was moved overland to another job, it was a common occurrence to see one of the engines pushing or pulling fifteen of these trucks.

Track Laying

A crew of four men was found to work to the best advantage. The amount of track this crew could lay depended largely upon natural conditions. After becoming thoroughly acquainted with the work and knowing how to take advantage of it, an average of 2,000 ft. could easily be laid and lined in one day. The track was usually laid the full length of the road and near the side of the prepared sub-grade. The construction of the road was started at the far end, and, as the work was completed, the track was pulled up and relaid on the next route, or brought into the yard and stacked in a pile ready for shipment.

In order to keep the track in good alignment one man was required to go over it continually looking for low joints and loose connections. This is important in case there are any steep grades, since it is absolutely necessary to keep the track in first-class shape in such places. Care in this matter greatly increases the efficiency of the engine. It was often necessary to increase the speed of the engine in order to climb the grade with the load. The train load was made up by placing ten or twelve loaded cars ahead of the engine and from twelve to sixteen loads behind, depending on the grade. Where grades were 4 per cent. or over, it was necessary for the train crew to drop the rear end of the train, push the cars in front of the engine to the top of the hill, and then back up for the rear end. This required but little extra time and made it possible to haul 30 to 40 cu. yds. a trip.

The cars were 1,000 lbs. steel dump, capable of dumping on either side, and having a capacity of ½ yd. of material. The dumping of the stone was handled by a brakeman and helper. The train was stopped at the proper place and eight to ten cars tipped over, dumping the stone about the centre of the prepared sub-grade. After the stone as dumped, the empties were pulled out and the track thrown over on the earth shoulder and realigned. By uniform loading the proper amount of stone was dumped from each car to make the desired thickness of stone in the road.

To increase the length of time that the engine might be out on the line a mule was used for yard switching. The watering plant consisted of a gasoline engine and an elevated tank with coal bins handy, so that coal and water could be taken at the same time, thus minimizing any delay to the engine. A small amount of time wasted on each trip due to poor organization and switching in the yard with the engine soon mounts up, and in the course of a day one or more trips may be lost which would add greatly to the cost of hauling.

Transfer Equipment Overland

Upon the completion of hauling stone for 8.5 miles of the road, the central loading station together with the entire equipment was transferred 6 miles overland to a new station. This was accomplished in six days by picking up the track in the rear and hauling and placing it ahead continuously. In this manner the entire equipment was moved quicker and cheaper than if it had all been picked up and loaded on railroad cars. The movement, including picking up and relaying track to the new location, cost $329.

Weather and Soil No Handicap

Weather conditions had little effect on the hauling, as only two days in the entire season were lost, and that was due to the fact that ¼ mile of the track was laid on low ground and the water was above the rails. The soil was of a heavy black mucky nature and one in which hauling by means of teams or tractors would have been greatly handicapped in wet weather. The only way in which it affected the industrial railway was to make the shifting of the track more difficult than in dry weather.

The equipment was leased for six months. A little less than five months' time was consumed in hauling 25,473 cu. yds. of stone with an average haul of 3.17 miles, which included unloading and reloading of equipment. The cost of hauling the stone on the rental basis, which included all expenses incurred in the hauling as well as freight both ways from Koppel, Pa., was 14.8 cents per ton-mile. The comparative cost of team haul on this particular job was estimated to be 28 to 30 cents per ton-mile, regardless of the fact that it would have been impossible to have secured a sufficient number of teams to have completed the work in a year. In this instance if the township had owned the equipment the cost per ton-mile would have been still lower. Assuming 20 per cent. for depreciation, also the necessary repairs to put the equipment in good working condition after use, the cost would have been 11 cents per ton-mile.

In conclusion, Mr. Tarrant states that some of the advantages to be derived from the use of industrial equipment are: Low cost of hauling; quicker hauling;

independence of weather conditions; freedom from labor strikes; reduction of number of men on the pay roll; no expense for resurfacing sub-grade; minimizing danger in passing over country bridges, due to light weight of equipment; and smallness of space required for operation.

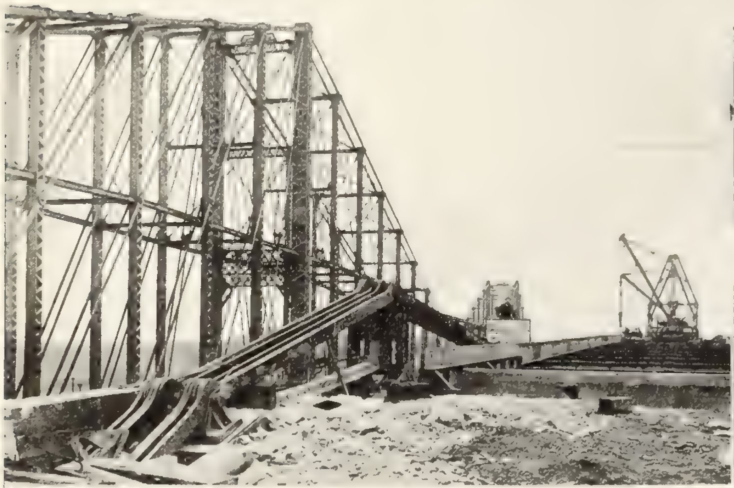
Highway Arch Bridge at St. John, N.B.

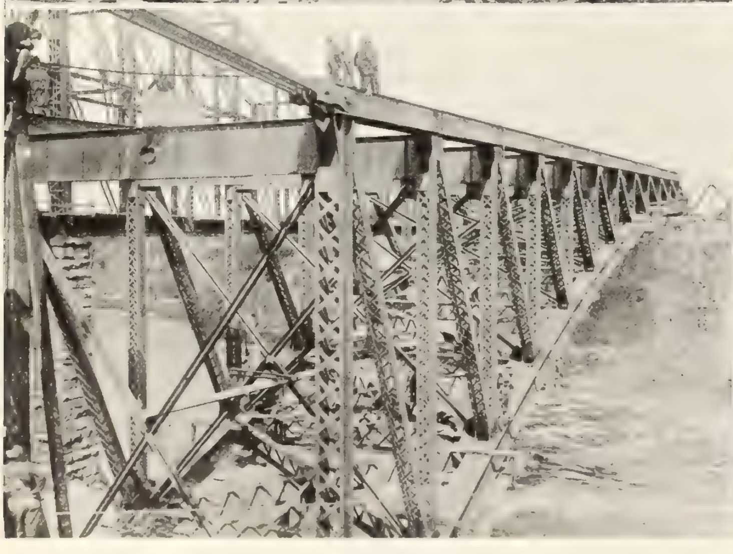
RANKING among the heaviest and shallowest structures of this type, the new highway arch bridge over the gorge of the St. John River was designed to carry city traffic, including a double track street railway. The arch spans the Reversible Falls between the railway cantilever and the old suspension bridge, which it will eventually replace. The floor of the new bridge is of reinforced concrete with a creosoted wood block surface, and with concrete slabs for the sidewalks. The latter are 7 feet wide and are partially cantilevered on brackets from the top chord. Between curbs the roadway measures 36 feet, the trolley poles for the electric railway being placed on the centre line while the lamp posts are incorporated in the railings at either side.

River traffic being considerable at slack tides, clearance was demanded as nearly as possible equal to that previously existing, consistent with good design and pleasing appearance; and this feature led to the adoption of the flat parabolic spandrel braced arch. The distance between centres of skew back pins is 565 feet, the height between skew back pins and the centre pin in the bottom chord being 61 feet 3 inches. The depth of the trusses is 60 feet at the end posts and 8 feet 6 inches at the centre, and they are spaced 41 feet apart centre to centre.

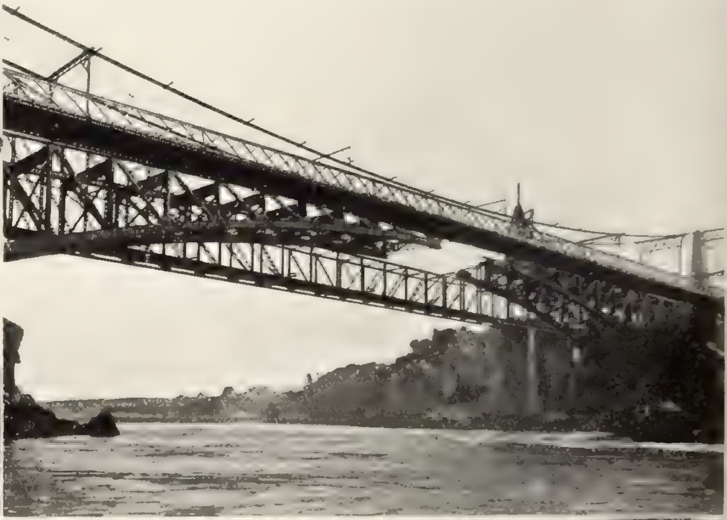
At each end of the arch there is an approach span of plate girder construction, equal in length to two panels of the main bridge, the total length between abutments thus being 654 feet. The steel in the structure, including railings and skew back castings, amounts to 2,181 tons.

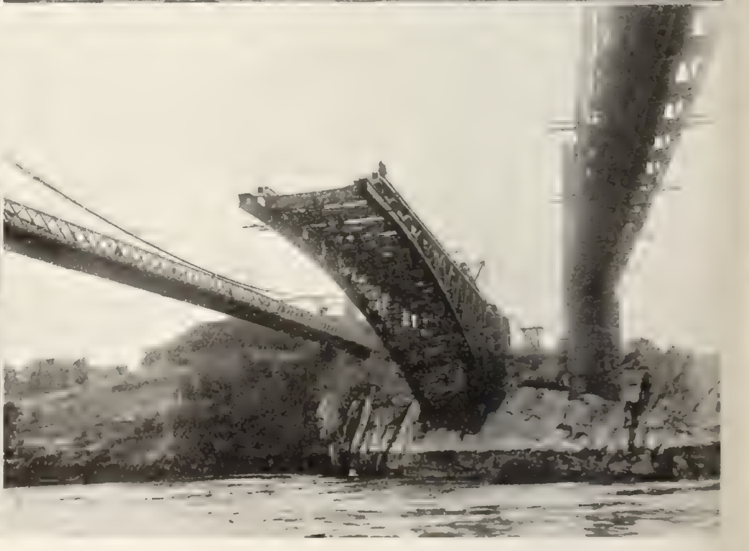
The span was erected as a cantilever from both ends, and upon the junction being made at the centre, the condition of a three-hinged arch was secured. By the insertion of the centre portion of top chord, accurately fitted and under no stress, all further dead load, such as flooring and minor steel work, as well as live



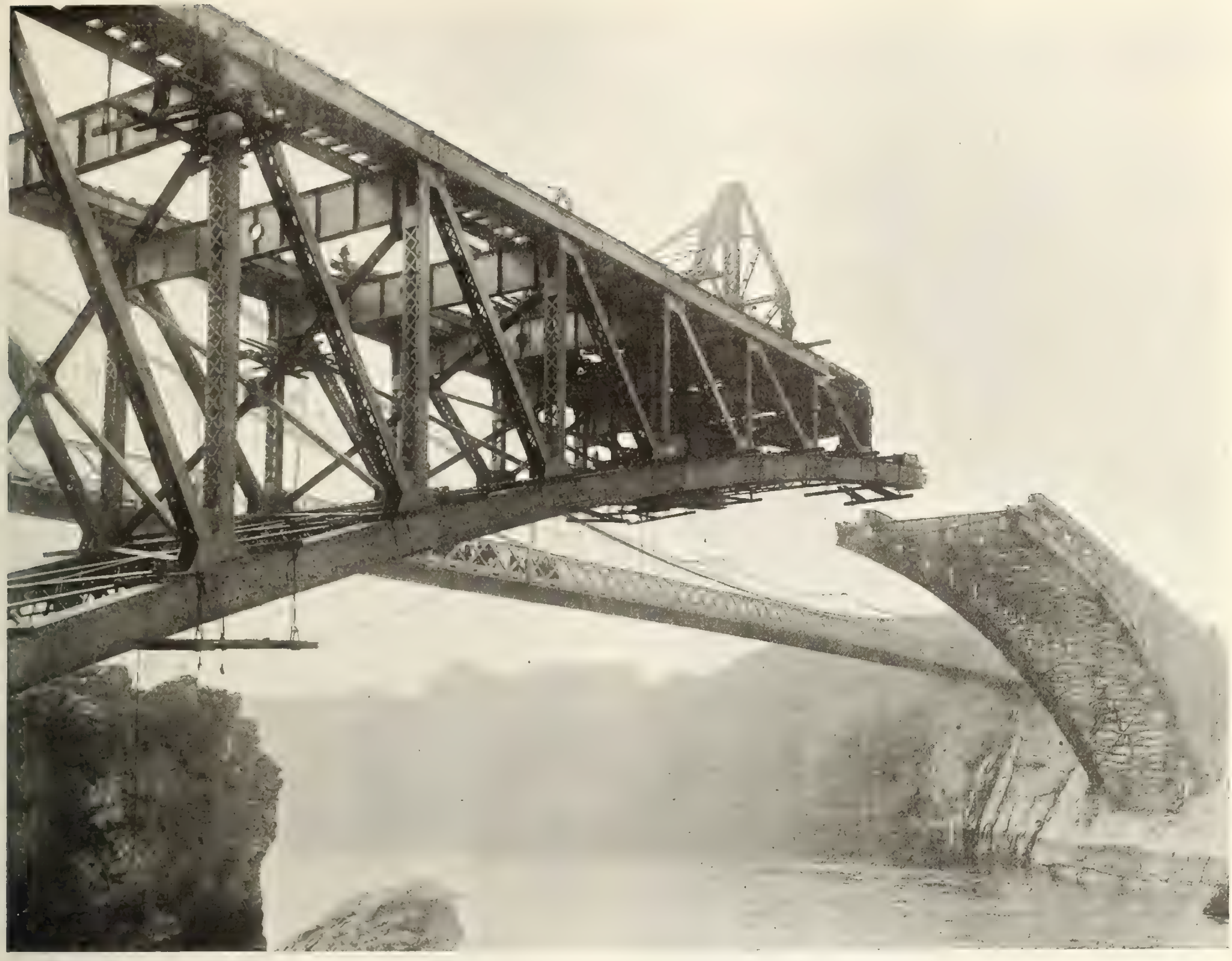


West end anchor bars.
West end cantilevered.





Erection of the east arm.
West arm from east bank.



Progress view of the construction of the St. John arch.

load, was carried by the truss as a two-hinged arch. The anchorage during erection was accomplished by connecting a chain of eye-bar members to the upper chord and guiding them by inclined shoes at pin points into anchor pits. The pits were excavated to a sufficient depth to secure ample reaction against uplift, chambers were hollowed out at the bottom, and crossbeams and girders served to engage the concrete with which the pits were then filled. By this means the weight and strength of the natural rock were used as anchorage factors, the total uplift in each pit being calculated at about 1,075 tons. Adjustment of the position of the cantilevered truss was made possible by the provision of a toggle arrangement, consisting simply of powerful hydraulic jacks, reaching against the abutment, and capable of lifting that pin point in each eyebar chain which was situated some fifty feet from the arch end post. Two 190-ton jacks for each truss were sufficient for all purposes, including the final adjustments necessary for the insertion of centre pin and centre top chord.

The photographs illustrate the erection progress as carried out last fall and serve also to indicate the character of the site. The uniqueness of the situation is realized when a suspension, a cantilever and an arch bridge are seen side by side.

The new span was built for the Province of New Brunswick, the general design being prepared by Mr. C. C. Schneider, of Philadelphia. The Dominion Bridge Company, of Montreal, were the contractors for the supply and erection of steel work, concrete flooring and the wood block pavement.

Storage of Cement

Many dealers who have made a success in the handling of cement insist upon laying a double floor in their warehouse, with a layer of building paper between. This insures beyond all doubt that no dampness will penetrate and be absorbed by the cement resting directly upon the floor. The same result is secured by laying blocks on the floor, and placing boards over them, thus providing a platform slightly raised above the storeroom floor. In any case it is well to cover the pile of bags with canvas or with building paper.

It goes without saying, of course, that any building in which cement is stored should be weather-proof, and should have its floor tight and not resting directly on the ground, and the floor should be provided with means for ventilation. It is advisable also to see that the cement is not stored in such a position that it will be exposed to draughts of damp, moisture-laden air from doors or other openings in the storage warehouse.

Cement, properly stored, can be carried from one season to another without deterioration. Long storage, however, tends to retard its setting, though not preventing its ultimate acquisition of full hardness and strength.

Construction Features of Power Development Work at Eugenia Falls, Ont.

RATHER more than a year and a half ago the Hydro-Electric Power Commission of Ontario obtained authority to proceed with the development of power at Eugenia Falls for the supply of the Owen Sound district. Plans and specifications were prepared, and tenders for the dams, canal, and flume line excavation and head works were taken in May, 1914. The contract for No. 1 dam was awarded to the Ambursen Hydraulic Construction Company, Montreal, and for No. 2 dam, as well as for the canal, flume line excavation and head works, the contract was awarded to the Hyland Construction Company, Toronto.
Toronto.

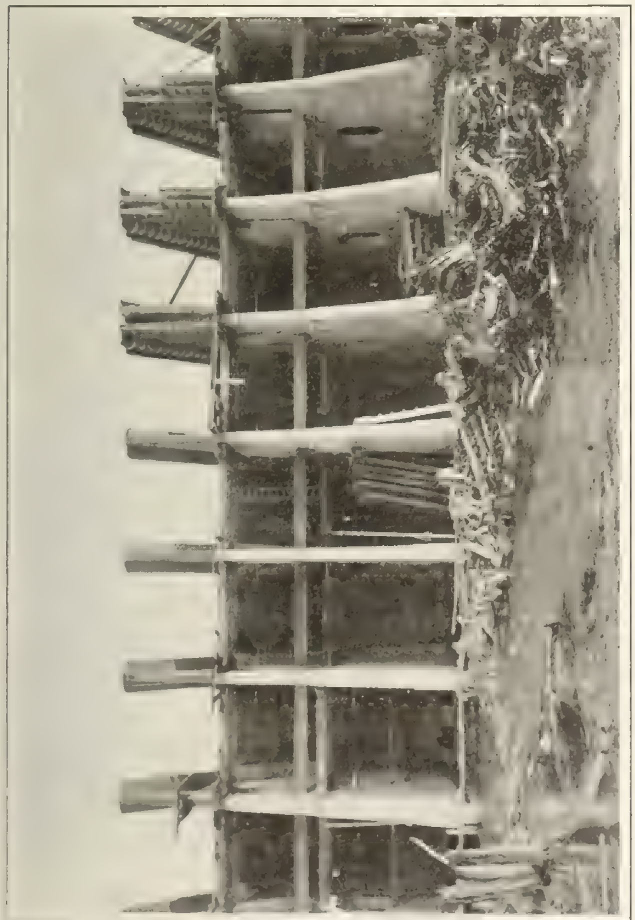
Portion of cut-off trench in No. 1 dam cleaned off ready for placing concrete.

Power house location and penstock line.

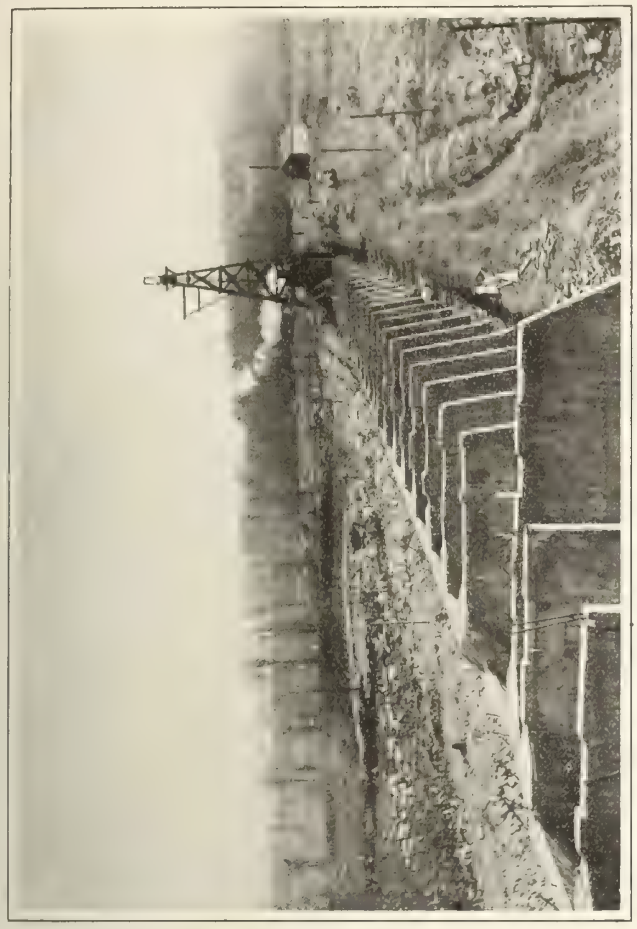
The Eugenia Falls Development is noteworthy as being the highest head in Canada east of the Rockies—530 feet. The ultimate capacity will be about 8,000 h.p., in four units, of which two only are being installed at present.

The general layout of the Eugenia Falls power development is shown in the accompanying illustrations. It consists essentially of a storage basin, about 1,650 acres in area, created by two dams. No. 1 Dam, located in the main channel of the stream, is of reinforced concrete construction, and No. 2 Dam, which closes a low contour in the side of the storage basin, is of earth fill construction, with a clay puddle core and rip-rapped faces. The canal leading from the main storage basin is designed to carry the maximum volume of water required for a peak capacity of 8,000 h.p. at minimum draft level. The gate house consists of reinforced concrete wing walls with mass concrete inlet piers having reinforced concrete curtain walls between them. In each of the two inlet openings is placed a 66-in. butterfly valve provided with a combined motor-operated and hand-operated mechanism. The water leaves the gate house through two 46-in. wood stave pipes, 3,350 feet long, operating under a maximum head of about 100 feet. The wood stave pipes are connected at the head block to two 52-in. riveted steel penstocks, 1,557 feet long, operating under an average static head of 530 feet. A cross-over connection to be controlled by a 36-in. valve is provided at the power-house end. The present installation consists of one wood pipe and one penstock, this being sufficient for the handling of the preliminary installed capacity of 4,000 e.h.p. At the junction of the wood stave pipe and the steel penstock, a differential surge tank is provided, and at the power-house end of the penstock is located a 50-in. butterfly valve operated by a hydraulic impulse motor.

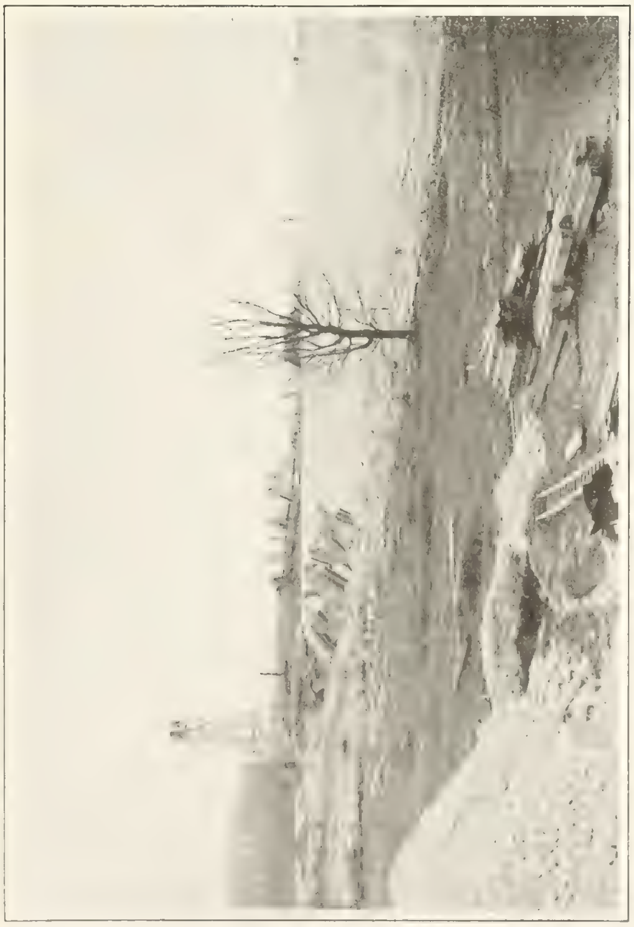
In the power-house substructure is to be installed a cast steel distributor pipe, with connections for two 2,250 h.p. turbines. These turbines are of the reaction



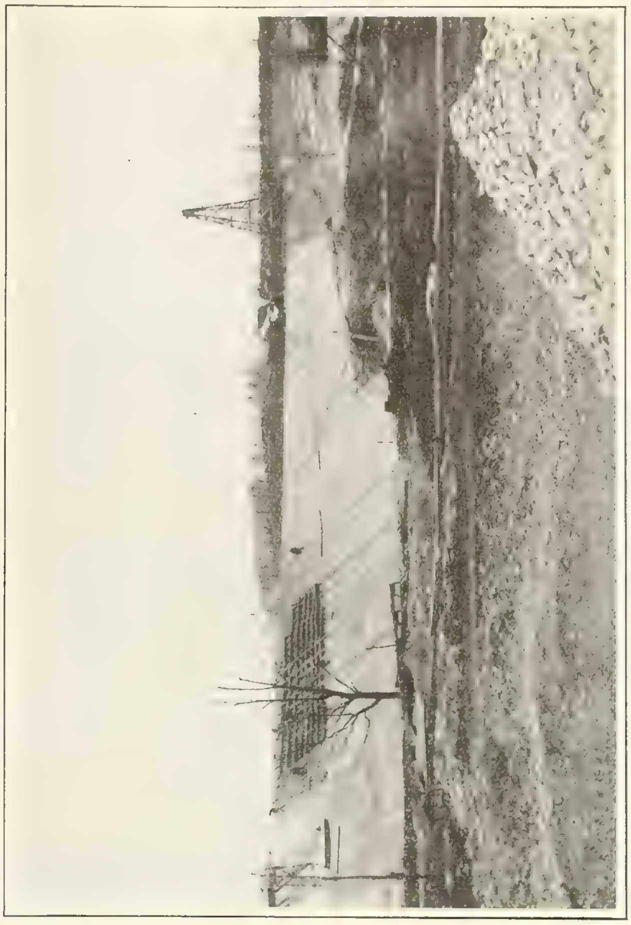
Buttresses of No. 1 dam in course of construction.



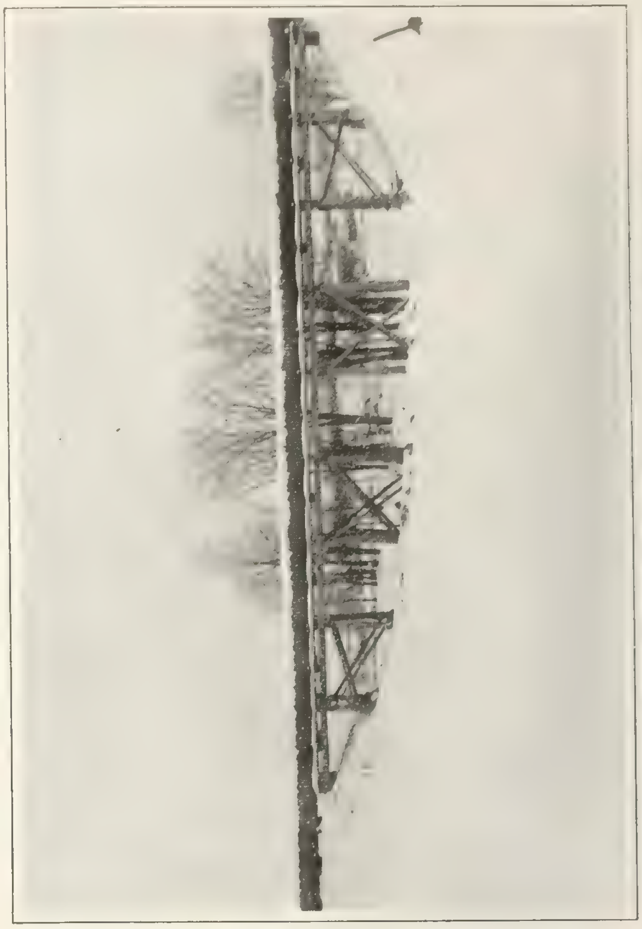
Line of partially completed buttresses.



North half of No. 1 dam.



South half of No. 1 dam.



Wood-stave pipe-line carried across a depression. Trestle built of cedar cut from the reservoir basin.

Lower end of canal, and gate-house substructure.

Up-stream face of No. 2 dam, showing unfinished rip-rap.

No. 2 dam in early stages of construction.

type with spiral wheel-cases and overhung runners. They will operate at 900 revolutions a minute, and are equipped with 6,000-lb. flywheels and automatic bypass relief valves direct connected to the governor.

Both contractors displayed great energy in starting and carrying on the work, with the result that the Hyland Construction Company finished all the work required of them within the time limit, and the Ambursen Hydraulic Construction Company not only fully met their contract obligations, but had so far completed the entire work on the contract that they were able to dismantle and partially remove their construction plant before Christmas.

Additional contracts for this work were awarded as follows: Wood stave pipe, Pacific Coast Pipe Company, Vancouver, B.C.; surge tank, Canadian Allis-Chalmers Company, Toronto; steel penstock, Thor Iron Works, Toronto; turbines, Escher Wyss & Company, Zurich, Switzerland; electrical equipment, Canadian Westinghouse Company.

Irrigation and Power Canal Design

By C. A. Farwell*

DURING the winter of 1912-13 the writer visited a number of irrigation and power projects in the West, to study costs and determine the best practice in the design and construction of concrete linings for large canals. The investigation included the alignment, grades and cross-sections of the canals. Data were obtained partly by observation and partly from the engineers associated with the work. The information was transmitted in the form of a report to the Pearson Engineering Corporation, New York City, for use in the design and construction of the canals of the Riegos y Fuerza del Ebro, S. A., Barcelona, Spain. Some of the points brought out are given by The Engineering Record.

Design

It is assumed that the capacity of the canal to be designed is fixed by outside considerations, either the available supply or the amount needed for the project. On irrigation work the main canal is designed for a constant flow over a period of several months of the year, while on power development there are hourly fluctuations, depending directly on the power loads. In this latter case it is of course necessary to make the canal of sufficient capacity to handle the "peak" loads. If at all possible it is customary to provide storage reservoirs above, and sometimes below, the power houses, to take care of these hourly fluctuations, as was done on the Los Angeles Aqueduct, where the conduit has a capacity, in general, of 430 sec.-ft., while the section which includes the power drops has a capacity of 1,000 sec.-ft. between two reservoirs. The shorter ths secton can be made the better.

In designing the cross-section of the canal, there are two general classes, into one of which the canal under consideration may be placed: (a) Where the grade is fixed by the topography or by elevatons of the intake and outlet, and (b) where the canal grade is not fixed, but is dependent on the relation between costs of construction and value of head.

(A) Where the Grade is Fixed

The fixing of the grade determines, within close limits, the velocity of the water in the canal and the area of the cross-section. The grade may be such that the velocity will be low enough to permit the use of an unlined canal, but even if this is the case, it is possible that lining will increase the capacity or cut down the excavation and seepage to an extent that will more than pay for the extra cost. In general, the points to be considered are as follows:

(1) General Shape of the Section.—The trapezoidal section is by far the most generally used, and any disadvantages that it may have are usually considered to be of no importance. It is claimed by some engineers that a small curve in the corners is an improvement, but this is doubtful. If the lining is not built in place, the semi-circular section is probably the most economical. Where there is any possibility of upward pressure on the bottom the curved bottom is an improvement, as it is very little, if any, more expensive than the flat bottom.

The relation of the bottom width to the depth is dependent largely on the cross slope of the country through which the location passes, but there is a certain proper hydraulic relation that should be considered. It can be shown by computation that there is a certain relation between the bottom width and the depth that gives a maximum hydraulic radius and a resulting maximum capacity for any given canal grade.

Theoretical computations, with assumed conditions closely approximating those actually encountered, will determine the most economical shape of section to use.

(2) Location with Relation to Natural Ground Surface.—In country where the cost is not excessive, it is considered good practice to locate the canal entirely in "thorough cut" if concrete lining is to be used. It seems to be practically impossible so to compact a fill that there will not be settlement, with its resulting displacement of the lining. Judgment must of course be used in determining to what extent the location shall follow the contour, as it is impossible to do away entirely with small fills in rough country.

It is noticeable that where canals have been built for some time and run into fills for short stretches there is almost invariably a large crack at, or near, the place where the canal passes from cut to fill or vice versa. Attempts are made to care for this, in more modern construction, by reinforcing the lining across the fill section, and this seems to be good design. Where it is necessary for a part of any section to be against other than natural material, as may happen on a very steep side hill, it appears to be good practice to lay up a rubble wall, either dry or with mortar, as a backing for the concrete. Otherwise the sides may be reinforced or buttressed at intervals, but where labor is cheap this latter type of construction would probably be the more expensive.

Freeboard

The amount of freeboard used is largely a matter of judgment, but this judgment shoud be based on several things, viz., the wave action, dependent on the velocities of the water in the canal, and of the wind;

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* Of the firm of Fay, Spofford & Thorndike, Boston.

the unknown action of the water surface on sharp curves and at changes of section; the desirable or possible "over-capacity" of the canal, and the damage that would result from an overtopping of the edge by the water. It might be advisable to build the lining only one-half or one-fourth of the distance from the theoretical water surface to the top of the bank, allowing the backfilled bank to supplement the concrete freeboard in extreme cases.

In regard to alignment, there seems to be no objection to curves down to 150 ft. radius or less, provided the velocity is not excessive.

It is doubtful, at least in the writer's opinion, if anything is gained, except possibly in appearance, by a too close adherence to the standard section or located line. After the excavation is made the lining should be placed on the side slopes as they lie. The bottom, of course, should be kept carefully to grade. For instance, if the excavation leaves the bottom a foot too wide in places, nothing would be gained by backfilling to the standard width. In the same way, if the alignment is off a few feet in places, no material harm is done. An extremely accurate alignment results only in a "nice looking" job, at considerable extra expense.

(3) Slope and Thickness of Side Lining.—This is almost entirely dependent on the nature of the material encountered. In a rock cut a thin lining (say 2-in. minimum) on a ½:1 slope is good practice; in a pervious soil, where there would be no danger of pressure behind the concrete, a thin lining on 1:1 or 1½:1 side slopes might be used. Other thicknesses would be used in other kinds of ground, and the question of just the proper thickness is dependent on local conditions. The slope can usually be safely made the stable slope of the material back of the concrete. Where there is danger of water pressure or of the action of frost behind the lining, this must be considered, and in some cases "weepers" may be put in at interals to prevent such pressure, these "weepers" to discharge into the canal or outside, as thought best.

(4) Expansion Joints.—If considered necessary, on account of a very porous backing, special joints may be used; but, as a rule, the cracks between the different panels of the lining, as built, serve all purpoess. Expansion of the concrete when thoroughly saturated with water tends to close all these temporary "contracting" cracks If found advisable, any cracks may be filled, after a season's operation, with cement grout or asphalt.

(5) Surface of the Concrete.—Where forms are used very little can be done to reduce the coefficient of friction after the removal of the forms. If the forms are carefully made, and maintained, of smooth lagging, and the concrete is well spaded, a dense, smooth surface is obtained that can hardly be improved. In order to fill any small air or water voids, it may be well to "wash" this surface with a thin grout, but even this is doubtful. The coefficient (n) in Kutter's formula for such a surface is about 0.013, and if clean metal forms are used may be as low as 0.012, but in the writer's opinion conservative practice would not permit of the use of a lower figure in the computations for the design.

Surfacing the Concrete Where Forms Are Not Used

Where forms are not used, the best practice seems to be to go over the surface with a lean mixture of sand and cement as soon as possible after placing the concrete. It is much better to do this within an hour or two than to allow a day or several days to pass before the plaster is put on. In the covered sections of the Los Angeles Aqueduct the concrete was very damp when the forms were removed, and remained that way for several days; hence the plastering could be delayed with less liability of inferior work.

Care must be taken in plastering, or the surface will "shell off" in time; some engineers are of the opinion that it is almost never entirely reliable. It would seem that the proper value for (n) is between 0.011 and 0.015, depending on the care used, with 0.013 for an average.

Considering the fact that a smooth and impervious concrete lining can only be obtained without forms by the use of a plaster coat, and this of questionable reliability, it seems better to use forms where at all possible.

(6) Reinforcing.—It is probably unnecessary to use reinforcing where the lining is laid on undisturbed or well settled material, unless such material is very porous and seepage dangerous, and even in such cases it seems better to lay the concrete without reinforcing in panels with special, watertight expansion joints. When lining is placed over fills it is good practice to reinforce.

(B) Where the Grade Is Not Fixed

Where the grade is not fixed a seventh factor, the value of head, must be taken into consideration. Between the cheapest possible development of the project and the most expensive there is a design that will give the largest return on the money invested. The grade of the canal is one of the important factors, and the relation between the cost of construction, which varies inversely with the grade (the steeper the grade the less the cost), and the value of head will determine the proper grade to use.

Methods of Construction

Two methods of preparing the surface for concreting have been generally used. In one, all overbreakage is filled with rubble, this method being necessarily confined to location wholly or partly in rock. In the other method the overbreakage is filled with tamped or puddled earth. The puddling may be done in two ways, either by the use of forms of the dimensions of the outside of the proposed concrete, or by the use of guides, where the material is tamped up to the proper line. The use of forms or guides is largely determined by the proposed use or absence of forms for the concrete, forms being used for the backfilling if forms are to be used for the concrete.

The sides are almost invariably concreted first. Where the slopes are ½:1 or steeper, forms are always used; where they are 1½:1 or flatter, no forms are used; but on the 1:1 slopes, both methods are in common use and engineers differ as to which method gives the better results at the lesser cost. The difference in opinion probably arises from the different systems used. It is the experience of the writer and others that if the lagging of the forms is carried up only a little ahead of the concrete no trouble is found in placing concrete behind forms on a 1:1 slope, or even on one considerably flatter.

Where forms are used the concrete is usually placed continuously in lengths of from 12 to 15 ft., with transverse joints between the panels. As soon as possible after the removal of the forms the surface is washed with a grout.

Where forms are not used the surface to be concreted is divided by guides into panels from 12 to 16 ft.

square, and alternate panels are placed. The guides are then removed and the remaining panels are concreted. Except in a few cases, no attempts have been made to provide expansion joints other than the planes of weakness occurring between panels put in at different times. These joints have in some cases been grouted and in others filled with hot asphalt. A "dry" concrete is necessarily used where there are no forms. A plaster coat is usually put on the surface after concreting, either immediately or within a few days, care being taken to keep the concrete damp in the meantime.

The mixer is ordinarily set on the bank and discharged into cars or carts running on or above the canal bottom, and from there is shovelled upon the slope or into the forms. As much spading as desired can be done back of forms, but concrete placed on slopes without forms can be "worked" only a little, with a resulting lack of density.

Costs

The costs obtained were not entirely reliable, as in many cases no accurate figures were available The minimum figure was 3¾ cents per square foot, for several miles of lining ¾-in. thick, laid under almost ideal conditions; the maximum was 25.7 cents per square foot, for a short piece of lining laid 8 ins. thick on the slopes and 6 ins. thick in the bottom. Practically all costs were between 2½ and 4 cents, with an average of a little more than 3 cents per square foot per inch of thickness.

Application is being made for the incorporation of the Export Association of Canada, Limited, whose head office will be at Montreal, and whose capital will be $500,000. The object of the new concern is to secure for Canada a larger portion of the world's trade under the changing conditions brought about by the war, and to develop and carry on the export trade in Canadian products upon lines of national co-operation. The Dominion Government, large railway companies, and manufacturing interests have promised their assistance. The Provisional Directors include Mr. G. H. Duggan, of the Dominion Bridge Company, Limited, Montreal; Mr. H. L. Frost, of the Frost Wire Fence Company, Limited, Hamilton; Mr. R. H. McMaster, of the Steel Company of Canada, Limited, Montreal; and Mr. W. W. Near, of the Page-Hersey Iron, Tube and Lead Company, Limited, Toronto.

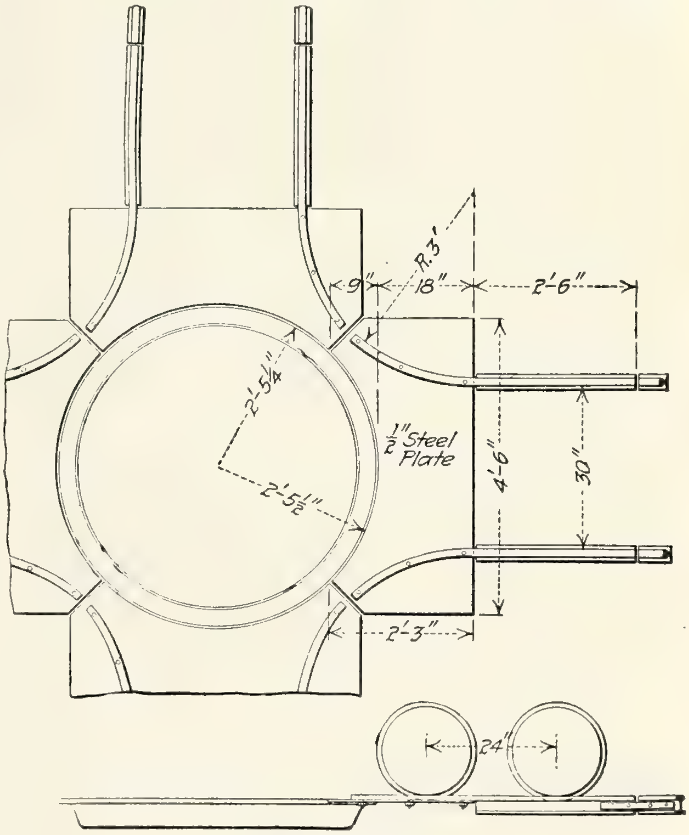
The U. S. Bureau of Standards has evolved a remarkable device for accurately indicating very small deflections of a steel bar 3 ft. long and 3½ ins. in diameter. This bar is supported at each end and a small mirror is fixed at the centre, above which is a frame bearing another partially silvered mirror, both of which reflect the light of a sodium burner, the lower mirror showing a series of black and yellow concentric rings. The slightest pressure on the bar—even the weight of a visiting card or a pin—causes these circlse to expand outward, forming as it were a series of ripples like those made when a stone is dropped into the centre of a still pond. The pressure of one finger on the bar causes the formation of five or six new circles, showing that the bar has been bent about 1/20,000 in., as each new circle means a 1/100,000-in. movement.

In Vancouver, B.C., there are 350 jitney buses operating on the city streets and suburban lines. In Winnipeg there are 572.

Improved Turntable for Contractors' Dump Cars

THE mucking tracks at the Bayonne shaft of the Newark Bay siphon tunnel for the Passaic Valley Sewer include several turntables, on account of the special track arrangement rendered necessary by certain shaft conditions. In the ordinary operation of turntables on industrial tracks the difficulty and loss of time in matching the tracks on the turntable with the fixed tracks are apt to cause frequent derailment, which means serious delay to the whole work. Great simplification of work at the turntable is secured on this job by a novel arrangement of the turntable approach tracks devised by R. H. Keays, Engineer for the contractors, the New York & New Jersey Construction Company, and described by the Engineering News.

The turntable approach, shown in the drawings with this article, has curved diverging track-ends at the approach, with a steel-plate apron between and around them. This apron is a trifle above the normal level of the wheel flanges, so that as the wheels mount the plate they ride on their flanges and become free from top of rail, running forward on the plate to the turntable. Coming off the turntable, the car will run on the plate into the flaring opening of the rail ends, and when the forward wheels come in contact with either rail the car is securely guided on to the track.



Turntable for dump cars.

The plate is fastened to the rail by countersunk bolts through the rail-head, the web and base of rail being cut away.

W. Steenburgh, shaft superintendent for the contractor, says that there have been no derailments at turntables and practically none on the entire trackage in the tunnel. The latter is credited to the care observed in keeping the tracks in good line and surface, which was thought necessary in order to have the electric storage-battery locomotives operate well.

Reinforced Concrete Construction

Its Advantages and Disadvantages: A Candid Survey of the Structural Functions and Limitations of this Modern Building Material

By Percy J. Waldram

CONCRETE is a material which has received, during the last few years, a considerable amount of[*] very skilful and successful advertising. The effect of this has been enhanced by the intricate nature of the mathematics and formulae by means of which it is commonly supposed to be calculated; and it is popularly regarded as a mysterious and wonderful material which is superior to the natural laws of structural mechanics—enormously strong, extremely cheap, and eminently suitable to almost every possible form of construction from a factory to a stationary cabinet. It is, in fact, far too frequently credited with the almost miraculous powers with which electricity was popularly invested some years ago before its physical and economic limitations became generally known. In many ways, electricity has exceeded the expectations which were formed of it, but we still use a little coal and oil for various purposes. Reinforced concrete has possibly similar unexpected triumphs awaiting it; but steel, wood, brick and stone are by no means obsolete yet. It would appear to be essentially the province of surveyors to form a fair and business-like estimation of its general physical character and of the conditions essential to its proper production; and when these are clearly grasped, the problem resolves itself into a matter of ordinary valuation.

The general physical properties of the material are fairly summed up in its title. It is concrete reinforced. The steel bones and tendons which we supply to the concrete flesh enable it to overcome that want of tensile strength which previously restricted its use to situations in which it could act in compression only—as in arches, arching floors, walls, footings, etc. But the presence of reinforcement does not make any very great difference to the nature of the concrete itself. The latter still remains an active partner in the firm, and the steel must work with it or dissolve partnership; and unless the steel reinforcement is made capable of carrying on the whole of the work, with the concrete acting merely as fireproofing material, dissolution of partnership means ruin.

Hence, even in beams which are reinforced in compression, we are constantly hampered in design by the capabilities of the concrete, which unfortunately are not very high; and in spite of all the important structural advantages resulting from a monolithic form of construction in which the strength of each part of a structure enhances that of its neighbors, reinforced concrete is necessarily heavy and weak for its size as compared with steel or wood. This disadvantage is partially balanced by its almost perfect durability, which enables us to utilize a greater proportion of its ultimate strength than is the case with more perishable materials. But in all cases where severe stresses and the dead weight of long spans are involved, it is useless to expect from it the same strength that we obtain from wood or steel of the same cost.

There are, however, situations where it would, for other reasons, pay to use the weaker material. When properly designed and properly made in situations where it is suitable, it is rot-proof, vermin-proof, fire-resisting, almost waterproof, and grows stronger with age instead of decaying. It can also be readily molded to any given form; and in entire structures, it is wonderfully monolithic, a very considerable advantage in bad foundations. But, at the same time, it is not a material to be used without accurate knowledge of its limitations. It must be designed with skill, made with more than customary care, carefully nursed during its infancy, and protected during the whole of its lifetime from agencies which are deleterious to cement, such as impermeating oils and acids. In some cases these disadvantages are immaterial, and it is the peculiar province of the surveyor to estimate them. In all situations where plain concrete, brickwork, or masonry would customarily be employed, it can be expected to do the same work with far less bulk of material. But, on the other hand, its use invariably entails extra expenditure in casing, which may or may not outweigh the saving of material. A retaining wall, for instance, in reinforced concrete, will do the same work as a solid brick or concrete gravity wall, at a fraction of the cost; but in ordinary dwelling-house solid walls, where there is not much thickness which can properly be saved, reinforced concrete and its casing must be expected to prove more expensive than brick or stone.

On account of the great difference between the stiffness of steel and concrete, as well as between their respective strength, it is a matter of no small mathematical difficulty to devise formulae which will tell us accurately how such an ill-matchel team are going to pull together upon any given load, and what work we can safely entrust to them without running the risk of the too willing steel being overworked, or setting a pace which the concrete cannot keep up with. Even at the present time, after engineering scientists all over the world have been engaged for years upon the subject, there are still problems which no textbooks meet. Many minds are, however, at work, endeavoring on the one hand to complete and standardize our knowledge, and on the other to simplify the mathematics involved.

Reinforced concrete suffers, and suffers badly, from the incubus of tedious and intricate calculations, and it is pleasing to be able to say that the results given by all formulae can be plotted to curves. When these are drawn to large scale, the slightest inaccuracy in calculating them is seen in some irregularity in the sweep of the curve. When they are used instead of the formulae, the designer's task is reduced to that of selecting values from a set of diagrams, in precisely the same way that he now selects a joist or the properties of a stanchion from a table or rolled sections. In my own office we have almost completely eliminated the necessity for using the long standard formulae, having plotted them all on diagrams. The saving of time and trouble effected by their use is enormous; but what is far more important is the notable gain in accuracy. If a draughtsman has a long and intricate formulae to work to, the chances of error are far greater than if he has merely to take a value from a plotted curve. Another important and unexpected advantage which results from the substitution of curves for tedious mathematics, is the rapidity with which the designer can grasp the possibilities of a problem, can compare reinforced concrete with other materials, and, if it is found suitable, select the particular form in which it will give the results which combine efficiency and economy. In a material which has a high ratio of dead weight to strength, it is frequently possible to secure a proper factor of safety only by eliminating all superfluous bulk. The subject of design in reinforced concrete is being extensively taught in technical institutions, and it is to be hoped that as the supply of skilled designers increases the disadvantage of excessive mathematics will disappear.

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[*] From a paper read before the Surveyors' Institute, London, Eng.

The necessity for skilled labor in construction is often considered to discount the use of reinforced concrete in remote country districts, where it would never pay to send specialist workmen. I would suggest, however, that it is rather a matter of the skilful supervision of the structural ability which is to be found in country and estate workmen. The more remote a district is from large centres of population, the more multifarious are the demands made upon the intelligence and ability of the local workmen. Opinions probably differ on the point; but personally I have always found country workmen remarkably intelligent, and can see no reason why a good estate mason should not very quickly be taught all that is required to make, or to supervise the making of, good reinforced concrete. If he is given good materials and clear drawings, all that is required is a somewhat unusually rigid attention to comparatively simple rules, which can easily be typed on a page or two of foolscap, or stated in his specifications. Any man who is capable of mixing and making really good concrete, who can read, understand, and carry out drawings intelligently, and who can be trusted loyally to adhere to instructions without varying them according to his own ideas, possesses all the necessary capabilities; but he cannot be expected to turn out good work in a material with regard to which he has no previous knowledge or traditional skill, unless his preliminary instructions are clear, definite, and complete. The necessity for skilled labor in the workman, and highly skilled intelligence in the foreman, is so often advanced as an argument against the execution of work otherwise than by a specialist firm, that I would venture to draw attention to a few practical points upon which this argument is largely based. They are seldom emphasized in textbooks, and, being comparatively immaterial in the making of plain concrete, their vital importance in reinforced work is apt to be overlooked.

Materials.—The stereotyped clause that "all materials should be the best of their respective kinds" is not one to be lightly interpreted. They must be of the very best. If the sand requires washing, it is far better out of the work altogether. Washing often removes those finer particles which are essential to a strong, dense mixture. The aeration of cement should never be necessary. If it is of the proper quality and sufficiently ground, it will have been properly aerated by the manufacturer, in which case further aeration will only tend to render it inert. Even if kept too long in sacks, it will be found to cake. Cement should be slow- or at least medium-setting, and should pass the standard tests. It should be recollected that comprehensive cement testing can be carried out only by an experienced specialist in a properly equipped and properly constructed laboratory. It is generally better to have the guarantee of a first-class manufacturer, supplemented by crushing tests on concrete cubes, than to trust to testing deliveries on the site. Unless the tester is experienced and his testing room is perfect, he must expect erratic results if he attempts anything beyond the simple tests for fineness and setting. The aggregate should consist of large, small, and medium-sized particles, the largest of which will easily pass between the reinforcing bars.

Grading and Proportioning.—The presence of small voids in ordinary concrete may be quite harmless, but in reinforced concrete mixing damp may enter and rust the rods, causing them to swell and burst off the cover. In beams there are high stresses concentrated on very small areas of cross-section, in which the presence of a void may be very serious. Voids may also interfere with the adhesion between metal and reinforcement at a vital point. It is therefore necessary to fix the proportions of the aggregate, sand, and cement, with some care, so that the interstices of the larger materials may be exactly filled by the smaller, and a thoroughly dense mixture secured. The deliveries of aggregate should be tested from time to time; and, if necessary, the proportions should be varied. The amount of smaller material necessary to fill up the voids in larger aggregate, and the proportion of voids in sand which must be filled with cement, can easily be obtained by placing a measured quantity of the larger material in a water-tight vessel, and filling in measured quantities of water until it becomes waterlogged. For all practical purposes this can be done as accurately by an intelligent gauger with a pail and a pint pot as by a chemist with accurate measuring instruments and the whole of the metric scale at his disposal. The shrinkage which takes place in the volume of material when wetted, must be remembered when estimating the volume necessary to fill the interstices of material of larger size. Ballast aggregate should never be assumed to possess the correct amount of sand. The latter should be screened out, and the correct proportion added back.

Steel.—There are on the market many types of patent reinforcement and varieties of hard-carbon steels. The advisability of adopting any of them in a given situation is a complicated question. For ordinary work, ordinary merchant bars of standard steel are difficult to beat.

Bending.—If reinforcements are, as they should be, kept as small as possible, all ordinary bendings can be done on the site by means of bending irons and a few iron pegs fixed into a wooden baulk. The only machine necessary for ordinary work is an efficient pair of shears. Loose scale should be cleaned off with a wire brush, but a slight coating of rust is not disadvantageous.

Casings and Falsework.—These should be made out of stout, well-seasoned wood, put together with a view to solid firmness while the concrete is setting, and afterwards coming away easily without jarring or hammering. Unless concrete is kept absolutely quiet and still until it hardens, the process of setting will be seriously interfered with or arrested altogether. For this reason the ideal connection for casings consists of outside bolts and straps; but the next best method is by square-cut nails with the heads left projecting half an inch, so that they can easily be drawn by the leverage of a claw-hammer or a split crowbar. Screws are apt to rust in badly, however well they may be greased. It generally pays to plane such parts of the casing as come into contact with the concrete, so that it will come away easily, leaving a smooth-finished face. With the same object in view the forms are sometimes oiled. This should be done with care. The oil should be thin and allowed to dry. Most fats and oils are deleterious to cement, but are especially so when the concrete is green.

Mixing and Placing of Concrete.—In all cases where the concrete will be heavily stressed in compression, it pays to use a rich, strong mixture (say 1:1½:3), rather than to make up the deficient strength of a weaker mixture by means of compressive reinforcement, which must always be expensive and uneconomical. When the mixing is done by hand, the sand and cement should be thoroughly mixed first until the color is a uniform grey; then the aggregate should be added and mixed; and finally the water in measured quantity, the whole being then turned over until it is of uniform consistency. Machine mixing should combine a tipping with a rotary motion, unless the rotating drum is provided with inside blades. A very simple and yet very efficient mixer is a large wooden barrel with a hopper door formed in one end. The barrel is filled about half-full or less; the hopper door is closed, and the barrel rolled along to where the concrete is required, the tapered ends giving the necessary combined pitch and roll to the contents. Experience will soon determine how far the barrel requires to be rolled before the contents are ready for the large aggregate and for the water to be added, and the measuring stations for these are arranged accordingly. The forms and centreing should be thoroughly drenched (not merely wetted) before the concrete is filled in.

Nursing of Green Concrete.—It is impossible to over-rate the importance of keeping the concrete thoroughly wet and perfectly still until setting is complete. It should be kept watered and protected from drying winds and sun for the first week or ten days of hardening, and it should be somebody's particular duty to see to this over week-ends and holidays. All sawdust from the making of forms should be carefully preserved for spreading over floors as soon as the surface is hard enough.

Test Cubes.—In all large work, small test cubes of concrete should be made from each batch of concrete, tamped to the same atmospheric conditions, and tested by crushing. Cubes of 4-in. side, or 6-in. cylinders, are usually specified; but it is not easy to construct a machine which will crush these. It is far better to have plenty of 3-in. cubes crushed on the site by a simple lever testing-machine made of 11-in. floor joists, than to send, at considerable expense, one or two 6-in. cubes to be crushed at the nearest town which possesses a 50-ton testing-machine. All the foregoing precautions are comparatively simple. Usually the difficulty is to get workmen to appreciate their importance. It is a good rule to have one person responsible for each particular matter which needs looking after, provided with clear typewritten instructions as to what he has to see to, and a definite penalty awaiting any carelessness. If the work is small, possibly one man can look after everything, in addition, perhaps, to doing part of the work himself; but two men should never share any one responsibility, however insignificant. Sooner or later both will overlook it, and each blame the other. We may, however, conclude that if clear, large-scale drawings in sufficient detail are supplied to the foreman, with carefully drawn-up instructions, there is no need to consider the necessity for skilled labor to be a matter which should weigh unduly against the use of the material.

The chief points in favor of reinforced concrete are:

1. Its freedom from decay and its improvement with age.
2. Its impermeability, which prevents insects and disease germs from harboring in it.
3. Its monolithic character.

Its chief disadvantages are:

1. Its cost.
2. Its weight and bulk for a given degree of strength.
3. The difficulty of making alterations in it, or of strengthening parts which prove to be weak.

When and Where Not to Use Reinforced Concrete.—Upon these general considerations it is possible to form a sound opinion as to whether in any given situation its use would probably prove advantageous or the reverse. It should be expected to show advantages in efficiency or economy, or both, in situations where:

(a) Fire risk is a predominant or an important consideration.

(b) Repairs and renewals are expensive, inconvenient, or difficult; or where neglected or unperceived decay is dangerous, as in sea reclamation works, reservoirs, storage tanks, etc.

(c) Where a hard, impervious surface, which can be readily cleaned, means money in the long run, as in the walls, floors, and fittings of farm buildings, and especially of dairies; in storage tanks, grain stores, silo, etc.

(d) Where it can be substituted for plain concrete, or thick masonry, as in retaining walls, foundations, rain-tanks forming the roofs of dairies, water towers, and above-ground silos.

(e) Where considerable repetition reduces the cost of centreing and falsework, as in piggeries and cow-barns, and their fittings, mangers, troughs, etc.

(f) In large complete buildings of a straightforward character, such as storage warehouses, especially on poor foundations.

It would be handicapped by its weight, bulk, cost, and by its permanent character where:

(a) Long spans or heavy loads are involved.

(b) Where steel or timber can be used for the same purposes without disadvantage.

(c) Where the work is small, and there is little or no repetition to enable casings to be re-used, as in single cottages.

(d) Where the finished details of the work are not or cannot be settled, or where a building is only required for a few years. Cutting or altering a reinforced building, or pulling it down for re-erection elsewhere, are all but impossible.

Recent contracts for shells placed in Canada include one for 1,500,000 shells awarded to the Dominion Steel Corporation at Sydney, N.S., one for 30,000 shells awarded to the Vancouver Engineering Company, Vancouver, B.C., and another for 100,000 shells given to the Loughead Manufacturing Company, of Sarnia, Ont. The Robb Foundry Company, of Amherst, N.S., have installed $30,000 worth of new machinery and will work three eight-hour shifts a day. The Saskatchewan Bridge & Iron Works, Moose Jaw, Sask., who have an order for one million dollars' worth of shells, are having new machinery shipped from the east, and expect to have it running twenty-four hours a day within a fortnight.

Maisonneuve Public Bath

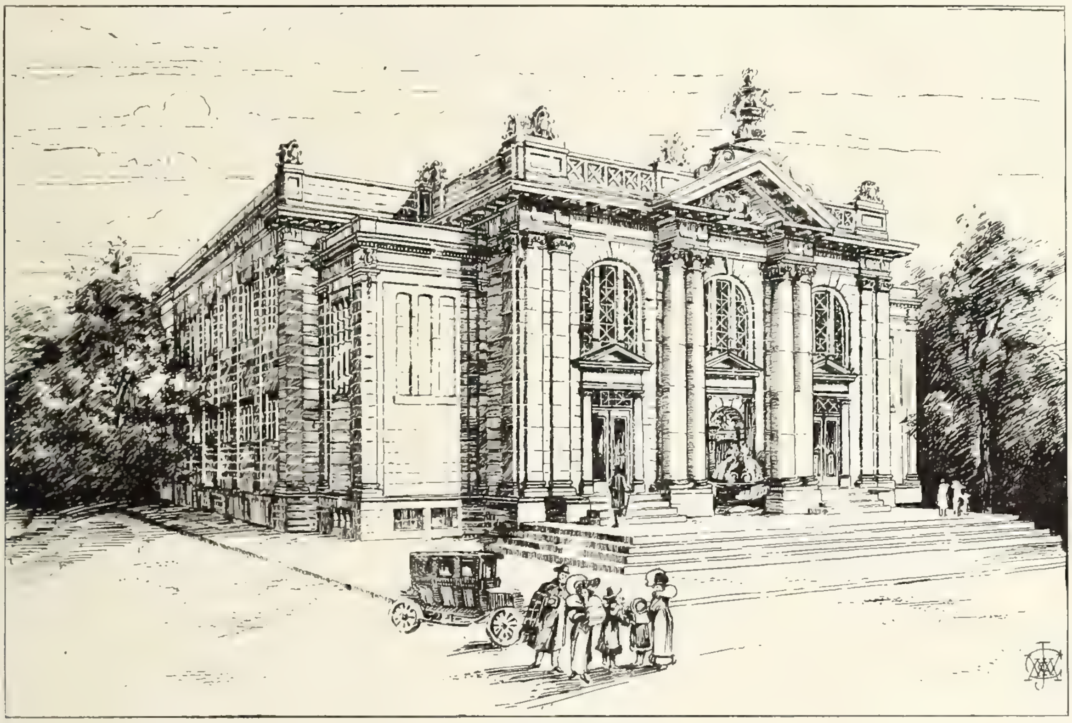
On instructions from the Town Council of Maisonneuve, Que., Mr. Marius Dufresne prepared plans for a public bath and gymnasium, which is now being erected by Mr. Theo. Lessard, Montreal. The site is on Morgan Boulevard, and has a frontage of 93 ft., and a depth of 144 ft. The structure will consist of a basement and two floors. The front portion of the exterior is of Indiana limestone backed with plastic brick, while the side walls are of Greendale Rug brick (supplied by Webster & Sons, Limited, Montreal), with Indiana limestone trimmings around the windows, the cornices being of stone. The base is of Stanstead granite, and the porch and the steps leading up to the two entrances are of the same material. A bronze fountain placed between four columns of Indiana limestone at the entrance was designed specially for the building.

Inside the entrances on the main floor is a caretaker's office, provided with two wickets, where the bathers secure suits and towels. From here run wide passages and walls on either side, separating the pool in the centre from rows of lockers built against the outside walls. Each locker has a shower bath. Entrance is gained from the lockers to the pool by crossing the passage-way and passing through doors in the inner wall on to a tiled walk. At one end of the pool there are private baths. The pool is provided with the usual springboards. Light is secured from a skylight in the roof.

The next floor is reached by two stairways running off from either side of the entrance hall. In effect the floor consists of a large gallery running round three sides of the ground floor, the centre portion being open so as to give light to the pool below. The gymnasium is located on either side of the gallery, the front portion of which is occupied by lockers and a caretaker's office, the latter being reached by a stairway from the caretaker's office on the ground floor. A balustrade is built out from the first floor over the pool.

Water is supplied by the mains of the Montreal Water and Power Company, and comes from an artesian well a short distance away. Water from the well is pumped into a large tank erected 80 ft. high, and flows into the bath by gravity. A power house adjoins the bath at the rear; it is one storey in height, and has two entrances from the street. Communication between the bath and the power house is provided by a door in the basement of the former, this giving access to a stairway leading directly into the basement of the power house. The house is equipped with two 85 horse-power Babcock & Wilcox boilers, with a pump of the Weir type. Steam from the boilers passes through three Presto heaters, by the J. W. Harris Manufacturing Company, Limited, Montreal, the heated water being supplied to the pool and shower baths, and for heating the building. By means of a tunnel, steam is also supplied to the adjoining public market, where it passes through two Presto heaters, thus giving the necessary hot water.

The foundations of the building are of reinforced concrete. The shell is carried on a steel frame, made by the Dominion Bridge Company, the Canadian Seigwart Beam Company, Montreal, having the contract for the supply of their reinforced hollow beams for floors and ceiling. The pool is made of reinforced concrete lined with plastic brick, which is faced with enamelled white brick supplied by Hyde and Sons, Limited, Montreal. The gymnasium floors are of hardwood, the ground floor of terrazzo, and the floors at the entrances are made of tile.



The Maisonneuve Public Bath.

Although the Federal Railway Commission decided to withhold judgment in a recent hearing at Petrolia, Ont., for the purpose of fixing a rate for the hauling of gravel in Western Ontario, it is generally believed that they will fix the rate at one cent per ton-mile. Should this be decided on, many of the western Ontario municipalities will commence the use of gravel dredged from the St. Clair River, which is of the purest quality obtainable, and the results should be reflected in a considerable improvement in the roads of the western end of the province.

Street Cleaning in Calgary

IMPROVED methods in street cleaning adopted by the street cleaning department of Calgary during the past year have resulted in increased efficiency in the work of the department, and though costs of operation have been reduced somewhat, the streets have been maintained in good condition. The new cost keeping system put in force by Superintendent T. F. Robbins about a year ago is producing excellent results.

The city, despite its population of only about 75,000, covers an area, it is stated, equal to that of Paris. It is divided for street cleaning purposes into two districts, in charge of each of which is a foreman. A third foreman looks after the work in both these districts in the night-time during the summer months, while during the winter he is put in charge of the work of cleaning the 1,200 catch basins, which must be kept open all the time in order to carry away the water from the melting snows.

Each of the regular foremen sub-divides his area into beats of from four to ten blocks and to each of these a street cleaner with a pushcart is assigned. There are at present 80 such men, who receive a wage of 28 cents an hour, seven hours constituting a day. The third foreman, whose gang also cleans the catch-basins, employs for this work six men who are paid on a monthly basis.

The sweepers fill their pushcarts with the sweepings and dump them into waste boxes, which are conveniently placed in alleys centrally located in each beat. These, in turn, are emptied by wagons and by two 5-ton motor trucks which convey the refuse to the dump or the incinerator.

In addition to the sweepers mentioned above, the department has four horse flushers, four rotary brooms, two electrically driven flushers, and five horse-drawn sprinkling tanks. It is especially due to the work of the motor-driven flushers that the streets are kept in such a clean condition, and because of their economy the horse-drawn brooms and sprinkling carts, although fairly satisfactory, will soon be replaced with motor equipment if Superintendent Robbins' plans are carried out.

The electrically driven flushers are each equipped with a tank having a capacity of 1,200 U. S. gallons. Each tank has a total length of 160 inches and an inside diameter of 51 inches and weighs 3,600 pounds. There is an air compartment in the forward end of each tank which is 36 inches long, designed to carry a pressure of 65 pounds. Each tank is provided with air and water pressure gauges and a pop safety valve in a by-pass connecting the water space with the air chamber. The tank is filled by means of a 2½-inch intake in the centre of the rear drumhead. The water discharge is controlled through lever gate valves operated by hand at the driver's seat, and by these levers two flusher nozzles may be worked together or independently. The main outlet connection is a 4½-inch pipe and the flushing nozzle connections are 2½-inch.

The two 5-ton electric trucks which are employed in hauling the street sweepings and refuse to the incinerator or the dump are each fitted with large boxes specially designed by Superintendent Robbins for the purpose. Each box carries approximately three wagon loads of refuse. They may be dumped by the driver from the seat. In addition to these, from 10 to 15 teams are constantly employed. When not needed for street cleaning work, these teams are hired to the public works department. This arrangement between the city departments has worked out very satisfactorily and has proven economical.

With the force and equipment mentioned, 1,356,482 yards of pavement—approximately 64 miles—were cleaned in 1914 at a cost of less than $120,000. This is a reduction of several thousand dollars on the figures for 1913, the saving being effected mostly by means of the modern machinery mentioned and by the efficiency methods introduced by Superintendent Robbins, who was appointed at the beginning of 1914.

During the year the street cleaners gathered and hauled to the various dumps 7,635 loads of street-sweepings. Snow removed from the business section of the city totalled 7,407 loads. For the purpose of filling holes in the pavements and sanding walks and streets when icy, 497 loads of earth, sand and cracked stone were hauled, making a total of 15,539 loads of material handled by the horse teams.

During the same period, the four horse brooms and the four flushers swept 4,576 blocks of pavement and flushed 2,184 of them, while the electric machines washed 5,535 blocks, making a total number of blocks cleaned by machinery of 12,295.

The number of tanks of water used during the year by the horse-drawn machinery for sweeping and flushing was 5,417 and 8,469 were used for sprinkling, making a total of 13,886. The number of tanks of water used by the electric machines was 18,113.

The electric flushers worked two shifts each day during the summer—nine hours of day and eight of night work. Their total mileage for the year was 17,759 miles, an average of 38 miles every day and 17 miles every night. Each truck used an average of $1.30 worth of electric current during the 17 hours. It is estimated that the use of these machines saved the city $24 a day on the cost of watering the streets. This economy was achieved despite very high fixed charges placed against the machines, which made the total expense during the season amount to $8,544.94, which works out at the rate of 48 cents a mile. The fixed charges included a depreciation based on a life of seven years and the total charge placed against them amounted to over $261 per month. It is understood that these figures will be revised for this year and the depreciation charge greatly reduced.

Superintendent Robbins estimated that one of these electrically driven machines does the work of three horse machines Teams are hired at $4.50 a day with the wage of the drivers included, and it will readily be seen that a large saving is effected.

The six men who look after the catch basins, when not so employed are used for other work, as when a heavy snow has fallen or in similar emergencies. Two teams are assigned to this squad in the winter and in the summer there are three, two of the men working in the business districts during the night with the extra team. These men also wash out the subway beneath the railway lines once a week on the average during the summer. Whenever there is a heavy fall of snow all these teams are used, if necessary, to remove it, while in the spring or during thaws in winter (which are fairly numerous) two of the men are assigned to go around with a steam boiler and thaw out the frozen catch basins. All of these men are on the monthly payroll and receive a straight wage of $75 per month.

An expense-saving appliance used by the department is the gutter plow for clearing sidewalks and

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*By W. E. Hardenburg in The Municipal Journal.

gutters of snow. This device does the work of several men at a small cost. The plows cost only $20 and six of them are used by the department. With the use of these, the men heap the snow in piles at the street corners, whence it is removed by bob-sleds, the lowness of which greatly facilitates the work of loading.

A factor in the savings that have been effected is the daily report which is made to the superintendent by the three foremen and all the drivers of machinery at the close of each day's work. These are compiled into a daily cost sheet by the superintendent and handed to the city commissioner early next day.

The total staff of the department at the present time includes Superintendent T. F. Robbins, three foremen, six catch basin men and 15 teamsters on the monthly payroll, and 80 street cleaners and two drivers of machinery on the daily roll.

Sand Analysis—the Need for Standardization of Methods and Apparatus

At the Convention of the American Waterworks Association held recently in Cincinnati, a paper—of which this article is an abstract—containing much information to sand users outside of the waterworks field was read by Mr. P. Burgess.

A few reasons for the necessity of standard methods are the increasing demand by engineers for better concrete sand specifications, the fact that the term "effective size" is not entirely satisfactory as applied to rapid-filter sand, and the confusion on the part of the manufacturers of sieves, who find it difficult to satisfy the specifications and requirements of engineers.

The economic features are evident in the case of concrete where the frequent weak and ambiguous specifications tend to increase the cost of the work and often to yield unsatisfactory results. From the filtration standpoint local sands are often available, but on account of lack of knowledge on the part of the local contractor, or on the part of the engineers in charge, such sands are seldom used. In consequence sand is often imported from considerable distance at an undue expense.

Much of the confusion has arisen from the arbitrary terms used by sanitary engineers, terms which have little or no significance to an ordinary contractor or the sand merchant in the business of sizing sands.

Confusion in Size Standards

Moreover, a further confusion has arisen from the endeavor to use the actual sizes of the sand grains rather than the sizes of the openings in the screens. It was early recognized and appreciated that there may be considerable variations in the sieve used for testing purposes in respect to the diameters of the wires and the spacings of the mesh. Consequently it was considered that the nominal spacings of the meshes per inch were of no consequence in determining the separation of a sieve. This view of the matter required a determination of the relation between the average diameter of the openings and the size of separation of a sieve, or more properly the determination of the actual size of separation of a sieve. Since few engineers have available the equipment required to standardize sieves, the results of analyses have been reported in many instances in terms of numbers of meshes or in wires per inch. This method of expressing results is indefinite and inaccurate, because wire cloth used in the manufacture of sieves frequently varies in the size of wires and number of meshes per inch.

Within recent years this difficulty has been appreciated by manufacturers, some of whom have endeavored to clear up the matter by producing standard testing sieves made in accordance with recent standard specifications and with certain arbitrary intervals of spacings between the individual units. By such means it is hoped to fix definitely the diameter of the openings in testing sieves. Recently the Bureau of Standards of the Department of Labor and Commerce at Washington has adopted standard specifications covering the manufacture of certain testing sieves; also, when solicited, this department stands ready to rate and standardize testing sieves at a nominal cost with a view of determining the actual average diameters of the openings.

Change From Sand Grain to Sieve Opening

The engineering profession should adopt a standard method and standard apparatus for making mechanical analyses of sands and gravels. It is believed also that simplicity and accuracy in reporting the results would be obtained by revising the methods commonly used at present to report such analyses. Possibly that feature which would tend most to clear up the situation would be to change the standard of measurement from the size of the sand grains to the size of opening in a sieve. In view of the fact that the coarser testing sieves such as are required for sand analyses can now be obtained with wires of very nearly uniform sizes and accurate spacings in both directions, it follows that such sieves will, within reasonable and sufficient accuracy, contain openings of certain definite sizes.

One of the difficulties to be encountered in such a change of standard would be to compare previous analyses with present or future requirements and conditions. Some years ago, at Philadelphia, a great many tests were made to determine the sizes of separation of two nests of sieves; also, to determine the relation between such sizes of separation and the diameters of openings in the screens. The average ratio of size of separation to size of opening was found to be 1.10 and was a constant within the limits of accuracy which can commonly be secured in making a mechanical analysis of sand.

Some of the finer sieves examined contained twilled cloth and not plain woven cloth. The average ratio of the size of separation of the twilled cloth to the average diameter of the opening in such sieves has been stated to be one reason why there is no constant relation between the diameter of opening and the separation of a sieve. As a fatter of fact, however, no difficulty need be encountered in obtaining plain woven wire cloth, even for the fine sieves, so that a nest of sieves may readily be obtained with a practically constant ratio of sizes of openings to sizes of separations throughout.

In determining the relation between the separations and openings in the sieves at Philadelphia, there were counted more than 250,000 sand grains and the work extended over a period of two months. The sieves were rated and re-rated until the curves of analyses obtained by examinations of the same sample of material by the two sets of sieves coincided throughout their entire length. Great care was taken, also, to secure accurate measurements of the diameters of the wires and of the number of meshes per inch in both directions, from several parts of the area of the cloth.

How to Help the Sand Contractor

Attention is drawn to the marked difference in engineering specifications and requirements for the preparation of sands used for filtration purposes. Frequently such specifications are limited to an expression of the maximum and minimum effective size and maximum and minimum uniformity coefficient. These terms mean nothing to the ordinary contractor who must furnish the material. It is obvious that the whole question of obtaining satisfactory material would be very much simplified if the specifications would read that a satisfactory sand would be one which contains not more or not less than certain specified quantities as separated by certain standard sieves. Such standard sieves would be available for the contractor, or manufacturer of the material, as well as for the engineer in charge of the work, who, under present circumstances and conditions, has the matter almost entirely in his own hands. This is true in regard to specifications for sand required not only for filtering material but also for any other purpose.

It is significant that the difficulties of the present situation are appreciated by some of the manufacturers of screens and testing sieves who have, in some cases, in their trade publications, gone into a discussion of testing sieves rather thoroughly with a view of meeting the demands of the engineering profession. The intervals between the wires of one company's sieves, or the diameters of the openings in the sieves, increase in a certain definite ratio, namely, the square root of 2, or 1.414. This ratio has certain obvious advantages because it permits the selection of sieves which give accurate ratios of separations of 1.414, 2, or 4 to 1.

It is believed that there would be a great advantage in simplicity of expression of results of analysis or in the form of specifications covering the preparation of filter sands if a statement were made to the effect that 10 per cent. of the sand passes, or shall pass, a standard sieve No. 35, or a standard sieve having an opening of 0.417 mm. in diameter, as compared with the usual statement that a sand has, or shall have, an "effective size" of 0.46 mm. Moreover, the term "effective size" has no significance whatever outside of its application to a filter sand, and, of itself alone, the term is of doubtful value as applied to sands such as are frequently used for rapid-sand filters. The range of sizes is believed to be much more significant.

Bonding Asphalt to Concrete

After making various unsuccessful attempts to apply asphalt direct to the interior of a concrete reservoir, a western engineer tried the expedient of first painting the concrete with hot coal car. After the asphalt had been applied it is said to have adhered so firmly that it could not be broken away without bringing off pieces of concrete.

New School Building at West Point Grey, Vancouver, B.C.

ILLUSTRATED herewith is a new school building now under construction at West Point Grey, Vancouver, B.C. The building, which is to have two storeys and basement, is designed for the accommodation of three hundred and twenty children. Special attention has been given to lighting, heating, and ventilating. The main entrance is in the south front. The corridors run east and west, and are well lighted from the staircase windows. There are to be eight class-rooms, each 24 ft. by 32 ft., four being on the west side, with a central entrance staircase, and four on the east. Cloak-rooms are placed at the exterior ends of the class-rooms, on the north and south sides. The balance of the building on the north side is taken up by an assembly hall. In the basement there are to be: boiler room, lunch-room, lavatories, and so on.

The building is of fire-proof construction, with reinforced concrete columns, beams, and floors. The exterior walls are brick and stone veneer, backed by 8-in. yellow tile. All the partitions are of yellow tile. The corridors have San-san composition flooring, while the remainder of the floors are finished with edge-grain fir. The exterior is being built principally of red brick and stone dressings.

West Point Grey School, Vancouver, B.C., now nearing completion.

The general contractors are The B. C. Granitoid, Limited; the architects are Messrs. Twizell & Twizell, Vancouver; and the Clerk of Works is Mr. R. W. Bridge.

ONE cannot help but smile upon seeing in a contemporary, "Industrial Canada," the advice to spend money freely, whether one really needs the articles purchased or not, because it helps industry and brings back prosperous times. It is the business man and the manufacturer whom we want to stir up in Canada to-day, and how many of this hard-headed species would purchase articles merely for the sake of helping industry? We had given "Industrial Canada" credit for more sense than to be fooled by the will-o'-the-wisp of philanthropy.

Governor Walsh, of Massachusetts, has signed the bill that authorizes the construction of new State highways to the extent of $2,500,000. The roads will be built in the counties of Berkshire, Franklin, Hampden, Hampshire and Worcester, and are to be completed within the years 1915-1918 inclusive.

Methods and Costs of Concrete Pavement Construction*

By M. P. Taylor†

A CONCRETE pavement was built last year which covers practically the whole south side of the town of Des Plaines, Illinois, and comprises 40,000 sq. yds. with curb, underdrainage system, etc. All the pavement laid was on a 20 ft. roadway except one street approximately one-half mile long where it was 22 ft. wide and another street in the business district where it was 30 ft. wide for a distance of a few hundred feet.

General Description.—The pavement was given a 3 in. crown on the 20 and 22 ft. roadways, and a 4 in. crown on the 30 ft. The concrete was laid 5 ins. thick at the sides of the roadway, and 7 ins. thick at the crown. Longitudinal expansion joints ½ in. wide were placed along the curb, and transverse expansion joints ¼ in. wide were placed every 25 ft. The transverse joints were of the armored type, Baker steel plates ¼ in. thick being used for protection. All the expansion joints were filled with tarred felt. Steel wire fabric weighing 4 lbs. to the square yard was placed in the concrete as reinforcement. This is much heavier reinforcement than that generally used in this type of pavement. The wire fabric came in 50-in. widths, which were lapped 2 ins. in laying.

The pavement laid is of the one course type which, while inferior to the two course in some particulars, has fewer difficulties of construction than the later. The concrete throughout was mixed in a 1:1½:3 proportion. Washed gravel and torpedo sand were used for the coarse and fine aggregates respectively. Both materials were excellent, being clean and well graded; the gravel was hard and durable, and the sand coarse and sharp. The gravel used ranged in size from ¼ in. to 1½ ins. Both fine and coarse aggregates were supplied from two separate sources, the pits being located at Algonquin, Ill., and at Waukesha, Wis.

Under Drainage.—The underdrainage was taken care of by 4 in. vitrified drain tile, laid 1½ ft. beneath the base of the curb. This pipe was of the hub and spigot variety and was laid with open joints around which were placed coarse cinders. The ditch was then back-filled with cinders up to the elevation of the bottom of the curb, forming a foundation for the latter. The drains were connected to the sewer system through catch basins where convenient or direct. It is thought that this system will effectually protect the pavement against frost, which has proven itself to be one of the worst enemies of a concrete pavement.

Sub-grade.—The sub-grade was black loam and heavy clay, and as a whole seemed to make a quite desirable base for the pavement. The main trouble with the sub-grade was its tendency to retain water, so that after a rain it was usually some time before the laying of the concrete could be resumed. After the excavating was finished, the sub-grade was brought to its final place by rolling with a three-wheel steam road roller weighing 10 tons. The sub-grade was given a crown of 1 in. Most of the excavation, which totalled 16,000 cu. yds., was done with wheeled scrapers.

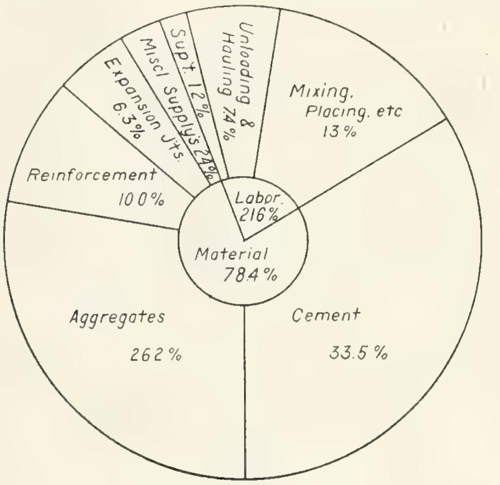

Fig. 1

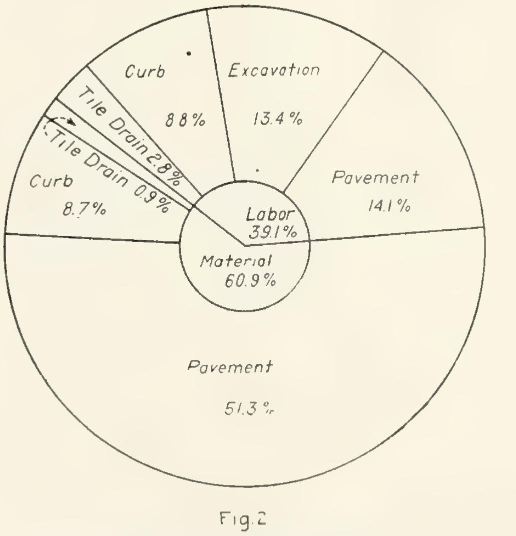

Fig. 2

Fig. 1 and 2—Diagrams showing apportionment of costs of reinforced concrete pavement.

Laying Pavement.—The work of laying the pavement proper was started September 1, and finished November 30. Various delays were incurred in the course of construction due to bad weather, plant break downs, and delays in receiving material. It was attempted to eliminate the latter difficulty by procuring the aggregates from two separate sources over two different railroads, but, while this proved advantageous for other reasons, it failed to some extent in accomplishing the desired end. One paving gang started work September 1, and on September 17 a second gang was started; both these gangs were retained until the end of the work, and when one was unable to pave for some reason or other, it was employed on some other branch of the work. Two entirely different styles of concrete mixers were employed by the two gangs, and this gives a chance for some very interesting comparisons in both method of construction and results. Both machines were traction mixers of a type specially designed for paving work. One was a gasoline mixer which deposited the concrete in place by means of a chute, while the other was a steam mixer with boom and bucket. The steam mixer seemed the more reli-

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*From Engineering and Contracting, Chicago.
†Engineer on Construction, Chicago, Ill.

able of the two, as more or less trouble was experienced with the mechanism of the gasoline mixer, though this may have been due to the unfamiliarity of it to the operator. The boom and bucket method proved to be the more satisfactory method of handling the concrete from the mixer, for the following reasons: (1) Less moving of the machine was required; (2) the concrete could be deposited more readily in the exact spot in which it was required; (3) a mixture of dryer consistency, which would have to be shovelled from a chute, could be handled readily. This last is an important point, as it is almost always a difficult matter to get the contractor to use as dry a mixture as desired, the wet mixture being more easily handled. On wide roadbeds especially the advantage of the boom and bucket is apparent. As a rule the gang with the steam mixer laid at least 25 per cent. more pavement in a day than the other gang. This was due probably to the reasons given above which allowed the concrete to bė handled more rapidly. The steam mixer was 2 cu. ft. larger than the other in drum capacity, but this had no effect, as both machines used a two sack batch, which they both handled readily. The actual working time on the paving was 55 days. Of this time two gangs worked 26 days, and the remainder of the time only one worked. The average work accomplished in a day was 714 sq. yds. The greatest amount of pavement laid in one day was 1,538 sq. yds by both gangs, 818 sq. yds. by one gang, and 720 sq. yds. by the other. This is a very good day's work, but not remarkable. The average day's work of the gang using the steam mixer was 557 sq. yds., and that of the other gang was 417 sq. yds.

The materials were measured by the conventional methods employed in such work; the cement was measured in sacks and the aggregates in wheelbarrows, the capacities of which were first determined. Quite accurate results were obtained by these methods, the average variation from standard in the amount of cement used in the 25 ft. sections being about 5 per cent. This variation was probably due in some extent to slight unevenness in the sub-grade.

On a large part of the work the grades were very flat and, in order to allow the surface water to run off more freely, additional pitch was given in the gutters, which varied in depths from 3 ins. at the summits to 7 ins. at the inlets. This meant that between the summit and the inlet the amount of crown of the pavement was constantly changing. This change was effected in the 3 ft. of pavement nearest the curb on both sides of the street, the middle part remaining unchanged. Where it was necessary to do this the steel plates for the expansion joints were secured in three pieces, a 14 ft. piece (if on a 20 ft. roadway) for the middle and a 3 ft. piece for each side. The 14 ft. piece had the same crown as the middle 14 ft. of an ordinary plate, and the 3 ft. pieces were straight.

In most concrete paving work the surface is given its final form by means of a strike board, or template reaching from curb to curb. On this work it was impracticable in many places to use a strike board of the ordinary type on account of the construction described above where the cross section of the pavement was constantly changing in shape. Therefore a strike board was not used at all, and the concrete was struck off with a lute or float about 8 ft. long. This implement was made of 1 in. lumber and was about 4 ins. wide at one end, and 2½ ins. at the other. At the wide end it was provided with hand grips about 2 ft. apart. Two men each using one of these lutes worked behind each machine and brought the concrete to surface. Although very good results were obtained by this method, it is not to be recommended for the work as a general thing. It involves too much of the personal equation of the workmen; the results depend entirely upon the ability and care shown by the men who do the striking off. It requires men skilled in the work, and capable of detecting any slight unevenness in the surface by the eye alone; whereas a strike board shows up the imperfections mechanically and can be operated by laboring men of the lowest class. After the concrete was brought to its final surface it was finished by means of a small wooden float. This produced the ordinary "floated" finish. The finishing was done from a bridge in order not to disturb the surface.

Curing.—To prevent the concrete from drying out and hardening too rapidly, it was subjected to a curing process as follows: After the pavement was laid and had become so hard that the surface would not be damaged, it was covered with a layer of dirt about 2 ins. in thickness which was kept thoroughly wet for a period of eight days. This covering remained on the pavement for a period of 15 days, during which time all traffic was kept off the pavement. During the latter part of October and the first of November the weather was quite cool (although not frosty) and the covering was dispensed with, although the pavement was sprinkled daily for the period of eight days. A proper curing process is regarded as second to nothing in importance in the effect it has of developing the full strength of the concrete.

Unloading material	$0.02
Hauling material	0.058
Charging mixer	0.034
Mixing concrete	0.025
Placing concrete, reinforcement and joints	0.028
Bringing surface to final grade	0.015
Finishing surface	0.013
Curing pavement	0.015
Superintendence	0.013
Total	$0.221

Costs.—No minutely exact record of the cost of the work was kept, but the data given in the following table is available and is very nearly correct. The itemized average cost of the labor per square yard of pavement is given. This is for the pavement proper, the sub-grade being already prepared.

In the item "mixing concrete" is included the cost of fuel, oil, etc., for the mixer. All the other items given are labor only. The cost given for superintendence is for superintendence of construction alone. Of course there are overhead expenses which should be charged to superintendence, but it is only attempted here to show the field costs.

The accompanying diagrams have been worked out and show the costs of the work on a percentage basis. Figure 1 shows the cost of the pavement proper, and Fig. 2 shows the cost complete, including excavation, underdrainage and curb. These take into consideration all costs except overhead office expense and depreciation.

Street railway passenger traffic in Winnipeg has decreased to such an extent since the advent of the jitneys that the Winnipeg Electric Railway Company has been forced to adopt economic measures, involving the reduction in the number of cars, a reorganization of routes, and a probable reduction in staff.

The Use of Road Oils on City Streets

THOUGH the use of oil on the streets of Iowa cities is increasing each year, and is now pretty general throughout the State, results have not been satisfactory in all cases. Believing this to be due in a great measure to improper application of the oils used, Prof. T. R. Agg, of the University of Iowa, has prepared instructions for this work, and they have been published in a bulletin of the Technical Service Bureau of the State. In view of the general necessity for some form of dust prevention the instructions prepared by Prof. Agg have a definite value and they are reprinted below.

Kind of Oil to Use

The oils commonly offered for street work are obtained from petroleum, but oils from some other sources are available at somewhat higher prices than are paid for petroleum products. The petroleum oils are supposed to contain "asphalt," but whether any particular sample does or does not depends upon the source of the oil and what is meant by the term "asphalt." As a matter of fact, few of the road oils do contain "asphalt" if we use the term in the strict sense, but it is not important what we call the black sticky portion of a road oil. If the oil contains good "body" and possesses some stickiness, while being fluid enough to penetrate the road slightly, it will serve to lay the dust. For ordinary conditions the oils containing from 40 per cent. to 50 per cent. of so-called "asphalt" are best. In general, the oils are fluid and greasy and have little binding value, so that they cannot be expected to give a dense, closely knit surface. Some of the oils, however, do contain a sticky constituent which has a binding value and probably adds to the stability of the roads.

If the street be very sandy or is of gravel or crushed stone macadam, there can be no question as to the advisability of using an oil that is sticky and free from the greasy characteristics of the ordinary petroleum oil; nevertheless, fair results can be obtained with many of the petroleum oils if they are handled properly.

Preparation of the Street

If a street is to be oiled for the first time, preparations should be started some weeks before the oil is actually applied.

The effect of the oiling is to render the earth partially impervious to moisture, and if the surface of the road be uneven when treated or becomes uneven afterward the depressions will become basins for holding water. Traffic will gradually work the soil and the water thus retained into mud, to the serious detriment of the street. If the street be smooth and well crowned, the water will run to the gutters so quickly that only in long continued wet weather will the street be softened to any great extent, and therefore traffic will not make any considerable amount of mud on the surface.

The principal object in oiling a street is to prevent dust; therefore there should be no dust on the street when the oil is applied. If dust has formed, it must be removed, which costs something. It would be better to treat the surface before the dust has formed, if possible.

For the best results the street oiling should be planned ahead and the preparation of the street carried out in the early summer so that the oiling can be done before a layer of dust forms on the street.

Grading

Good results with oil cannot be expected on a flat and poorly drained street. Early in the summer the street should be carefully rounded up with an even slope from the middle of the gutter. The gutter or ditch should be deep enough to readily carry the water and to permit a slope of about an inch to the foot from the middle of the street to the gutter. Generally, the bottom of the gutter should be about eighteen inches below the middle of the street where the width of the street is not over 35 feet between gutters. This is about right on a residence street. On a business street having a width of 50 feet, the bottom of the gutter should be at least two feet below the middle of the street.

After the street has been shaped with a grader, it will undergo a period of settling, during which some depressions and uneven places will appear. These should be filled with earth and the entire roadway be kept dragged until it finally becomes hard and smooth and free from depressions.

It is very important to secure a firm, smooth surface for the oil, and the small expense incurred will be more than made up by the increased effectiveness of the oil treatment.

When the street has been brought to this stage it is ready for oiling. Usually the best time is during the latter part of May and during June. If the oiling is delayed until a layer of dust has formed on the street, it is best to scrape off most of it before oiling.

The decision to oil a street may sometimes be reached after the summer is well along and the streets have become hard and dry. In that event, it is not advisable to do any extensive earth work, because at this time of year newly placed earth will not compact readily, and if oiled before well packed the results are unsatisfactory. Such a condition is not ideal and only poor results can be expected.

Applying Oil

After the street has been prepared as described, the oil should be applied, the quantity being one-third gallon to one-half gallon per square yard of surface. If the street has never been oiled before, or if more than a season has elapsed since a previous oiling, the quantity used should be about one-half gallon per square yard, but if the street is being oiled regularly each season, about one-third gallon per square yard is sufficient after the first year. When the oil is being applied on a busy street in the business district it is necessary to oil every year, using about one-half gallon per square yard of surface for each oiling. In many towns the business streets are oiled twice a year.

An ordinary street sprinkler may be used for distributing the oil, and after a few trials the operator can get his spray adjusted so as to deliver about the proper amount of oil and spread it evenly. Care must be taken to secure a nice even distribution of the oil and to avoid forming pools or covering sidewalks and crossings. Many of the disagreeable features of street oiling can be avoided if care be taken to keep sidewalks and crossings clean. The crossings may be covered with dust or sand before the oil is spread so as to keep them clean. After the street has been under traffic the crossings may be cleaned and from that time no trouble will be experienced.

If a street sprinkler be not available for delivering the oil, a thresher or any similar tank can be used by attaching a pipe at the back for distributing the oil. The best pipe distributor consists of an 8-foot length of two-inch pipe made up with a tee at the middle and caps at the end. Along this pipe, tee included, should be drilled two rows of one-eighth inch holes one inch centre to centre in the rows. This pipe is connected at the rear of the tank so that it will hang about one foot from the ground, and parallel to it, the connection to the tank being made with two-inch pipe in which there is an ordinary blow-off cock or gate valve. A little better distribution will be secured if a "spatter" board is suspended just under the spray pipe so that the oil will strike the board and will break up into spray before striking the ground.

This will make it possible to cover the surface fairly uniformly instead of in streaks as will be the case if no board is used.

After the oil has been spread it should stand without being covered for about a day. Then it should be covered with just enough sand to keep the oil from picking up. Emphasis is placed on the importance of using sand for this purpose rather than dust from the old road surface. The amount of sand needed is only two or three loads per block, and at any reasonable price the benefits derived from the use of sand justify its use, wherever it can be secured.

After the road has been put in service, it may be apparent that more sand is needed in spots, and such places should be covered lightly, the covering being repeated two or three times if necessary. Use just enough sand to keep traffic from picking up patches of the surface.

When a residence street is oiled the second time, the method to be followed is exactly the same as is followed the first time, except that the quantity of oil used may be reduced to about one-third gallon per square yard of surface. It is advisable to repeat the oiling the second year in any case, though it may be omitted the third year and resumed the fourth year. Better results would be obtained if the work were done every year.

Results to Be Expected

Surface oiling finally results in a street covered with a layer of granular soil which is oil saturated and consequently does not blow about readily. The suppression of dust is the principal benefit to be expected. Beneath the thin layer of loose oil-soaked soil the firmer portion of the street is saturated with oil for a depth that varies from one inch to perhaps six inches.

Water penetrates this layer rather slowly. If the street has plenty of cross slope so that water does not stand on the surface, only a small amount of mud will form under light or moderate traffic. A street that is oiled systematically for a series of years gradually acquires an oil-soaked crust which becomes more and more impervious as the oiling is repeated. An oiled street never gets to the place where it will not be muddy in seasons of heavy rainfall, nor will the surface be stable in ordinary wet weather if the road carries heavy traffic.

Unloading the Oil From Tank Cars

The oils used for dust suppression can be purchased so much more cheaply in tank car lots than in barrels that it is always advisable to purchase in such lots. If the town be so fortunate as to have a siding or embankment 8 or 10 feet high, the car can be placed thereon and the oil allowed to run into the sprinkler wagon from the tap in the bottom of the tank car.

Usually such a siding is not available and in that case the oil must be pumped from car to wagon. For this purpose the ordinary tank pump used with traction engine tanks is as good as anything. It should be placed on top of the tank car with all connections made of pipe, as hose does not last long in oil. If a small steam or gas engine driven pump be available it will of course be faster than a hand pump, but it is not worth while to purchase one for a small amount of work.

Cost of Surface Oiling

The cost of preparing a street for the oil treatment may vary from 25 cents to $1 per lot 60 feet wide, but it is hardly proper to charge extensive earth work against the oiling. The street ought to be kept well shaped up regardless of whether it be oiled or not.

Some cleaning is almost always necessary prior to the oiling, which costs from 30 cents to 50 cents for each 60-foot lot where the street is oiled about 25 feet wide. The oil can be unloaded, hauled and distributed for about $2 per lot including the cost of covering oil with sand. The cost of the oil will be about $1 per lot, and the cost of sand about 25 cents per lot. The total cost for each 60-foot lot on each side of the street is as follows:

Cleaning the street	$ .40
Applying oil and covering with sand	2.00
Cost of oil	1.00
Cost of sand	.25
Total	$3.65

These prices are about an average and will serve as a guide in estimating the cost of work of this class. Oiling is often done considerably cheaper and in other instances has cost more. It is assumed that the application will consist of about one-half gallon per square yard of surface and that the oil will cost 4 cents per gallon.

Oiling Macadam Roads

When oil is used to prevent dust on a new broken stone or gravel macadam road it should be applied after the road has been well seasoned, but before traffic has brushed off the fine material from the surface. Usually a road will reach the proper condition within a year after it is built, but the time varies greatly. If allowed to go too long, the surface will be a little rough after oiling. If oiled too soon, a putty-like mat will form which will scab off the surface under traffic.

If an old macadam road is to be oiled it should be repaired and thus brought to a smooth even surface. It should then be placed under traffic just long enough to get a good texture to the surface before the oil is applied.

A macadam road is in the proper condition to oil when it has a true cross section and a uniform surface whose texture is close and compact but upon which there is very little loose binder, be it either sandy loam or stone screenings. If the surface be porous, the oil will penetrate too deeply and will interfere with the bond of the surface. If the surface be covered with fine material, the oil will mix with it and form a mat covering which is not durable.

It should be noted that the general statements made above apply only in those cases where a light petroleum oil is used for dust laying and not to the construction of macadam by the penetration method.

Tests were recently made at Columbia University, New York City, to determine the relative strength of concrete made with slag and with trap-rock as aggregate. The trap-rock was graded into ¾, ½, and ¼-in. sizes and smaller; and the sand was "Cow Bay," a typical product from Long Island. The mixture was a 1:2:4, and the test pieces were cured 28 days. The slag concrete, though the lighter in weight (140.6 lbs. per cu. ft., as compared with 154.5 lbs. for the trap-rock concrete), proved to be considerably the stronger of the two. Its compressive strength per sq. in. was 2,465.5 lbs., while that of the heavier trap-rock test was only 1,975.5 lbs.

Plans now completed by the Ontario Government for extensive road construction in northern Ontario contemplate the expenditure this season of $615,000 upon the work. The sum of $90,000 will be devoted to a highway along the route of the Temiskaming & Northern Ontario Railway, and $75,000 to a road along the Transcontinental Railway. A trunk road will be constructed from Sturgeon Falls to Sudbury. Apportionments for road-building are also made to various districts as follows: Rainy River, $35,000; Kenora, $25,000; Port Arthur, $40,000; Fort William, $50,000; Sault Ste. Marie, $50,000; Sudbury, $40,000; North Bay, $50,000; Nipissing, $35,000; Haileybury and South Lorrain, $55,000; other roads, $102,000.

Personal Mention

Mr. E. S. Mathieson, Amherst, N.S., has been appointed Town Engineer of Trenton, N.S.

Mr. E. J. Holland, City Engineer of Guelph, Ont., has been appointed Building Inspector, in succession to Mr. Lambert.

Mr. J. H. Kennedy, who has been in the service of the Vancouver, Victoria and Eastern Railway for fourteen years, part of the time as Assistant Chief Engineer, is retiring.

Mr. L. C. Ord, Works Manager of the C. P. R. Angus Shops, was elected President of the Canadian Railway Club at the recent annual meeting of that body held in Montreal.

Mr. George E. Templeman has been appointed Superintendent of Construction and Maintenance of the Montreal Electrical Commission, in succession to Mr. D. B. McIntyre, resigned.

A private cablegram from Mr. R. D. Brown, former City Engineer of St. Catharines, confirms an unofficial report that Private Walter B. Scott, Assistant City Engineer of that city, has been killed.

With the death of Mr. A. A. Cruickshank, the Government of British Columbia have lost a competent official. Formerly a contractor, Mr. Cruickshank was appointed Road Superintendent for the Chilliwack District in 1909, in which capacity he held the reputation of being the best road builder in the province.

A cable from London, Eng., announces the death at the front of Lieut. C. A. R. Tennant, of Montreal. He was connected with the firm of C. Tennant, Sons & Company, Montreal, Limited, a branch of the well-known British firm of iron and steel, wire rope and chain, cast iron pipe and chemical merchants.

Mr. W. T. Donnelly, of New York, Consulting Engineer for the Grand Trunk Pacific Railway, recently inspected the big G. T. P. drydock at Prince Rupert, B.C. He expects that this floating dock, which is estimated to cost $2,500,000, will be completed in a few weeks. The dock, which has a capacity of 20,000 tons, is 604 feet long and 130 feet wide.

Mr. W. J. Francis, C.E., of Montreal, is advising the city officials of Peterborough with regard to the city's new sewerage project. This work, which involves an outlay of a quarter of a million dollars, will include a pumping station to pump the sewage across the river to the disposal plant, and Mr. Francis has been called in to decide the best location for the pumping station.

Mr. James Barr, a member of the staff of the Toronto Civic Works Department, was among those who went down on the Lusitania. The late Mr. Barr, who was born in 1885, was a graduate of the University of Glasgow. He entered the service of the Works Department in 1910, and later became Chief Assistant to Mr. James Milne, Mechanical and Electrical Engineer for the city.

Mr. Thomas Adams, of the Commission of Conservation, Ottawa, is making a tour of the West, and spoke last week in Regina, Calgary, Swift Current and Medicine Hat. Mr. Adams in all cases emphasized the necessity of taking care of the growth of the cities in order that future populations should have no cause to complain of the way in which the cities had been built up, and said that the young cities of the West had only to profit by the experience of the eastern cities rather than to follow their example and grow up haphazard.

S. H. Mundheim, the German manager of the Cement Products of Canada, whose plant is located on the Island of Orleans, in the St. Lawrence, a few miles below Quebec, has been taken into custody by officers of the Alien Enemies Department, and will be interned during the period of the war. His German passport showed that he had held the rank of a captain in the German army. The plant of which he was manager employs many Germans, and has been constantly under military surveillance. No reasons have been assigned for his sudden arrest.

Mr. Robert Munro, for many years President of the Canada Paint Company, died in Montreal on May 22. Mr. Munro was a Scotchman, and in 1890 came to Canada to establish a branch of the Alexander Ferguson Company of Glasgow, paint manufacturers; subsequently he formed a company and bought the business, which was operated under the name of the Canada Paint Company, and for about fifteen years he remained with the concern as Managing Director, until the business was acquired by the Sherwin-Williams Company. He retired from active business three years ago.

Charles Leonard Weisner, for the last five years General Manager of the National Fire Proofing Company of Canada, Limited, died at his home in Toronto on May 15th. He was born in Buffalo, N.Y., in 1863, and located in Toronto eleven years ago, having been connected with several contracting firms until he became agent for the National Fire Proofing Company of Pittsburgh, Pa. Later, when the Canadian company was formed, he was appointed to the position he held at the time of his death. He was a member of the Engineers' Club of Montreal. He is survived by his widow, one daughter, and two sons.

Vancouver has lost one of its pioneers in the person of Mr. Walter Moberly, who died recently at that city. He was born in England in 1832, and came to Canada in 1842. His first experience as an engineer was gained on the Northern Railway, which was built to connect Toronto with Barrie and Penetanguishene. In 1858 he went to Victoria, B.C., and later he laid out the city known as New Westminster. He was employed in making the survey for the transcontinental line, and on the completion of these surveys Mr. Moberly took up his residence in Winnipeg, where he carried on his profession as an engineer and architect.

Grant, Smith & McDonnell, the contractors for the new piers being built for the Government at Ogden Point, B.C., are building additional cribs at Esquimalt. They intend to build three cribs together on the ways, and for this purpose the structure is being extended. Under the new arrangement it is expected that the work will be considerably facilitated, every modern means in the shape of machinery and material being available at the Rosebank quarries.

Another step has been taken in the direction of making a start on the construction of the new Union Station at Toronto. The obstacle that has been holding up the financing of the scheme has been removed by the City Council, though somewhat against their will. The G. T. R. and the city could not agree on one of the terms governing the railroad lease of the city's property, but the Council at last decided to accede to the demands of the G. T. R. in order to get the work started as soon as possible. Now that the transfer of the property in question has been arranged it is said that the Toronto Terminal Company will have no difficulty in financing the work.

The United States Cast Iron Pipe & Foundry Company are opening a new office in Kansas City, Mo., at 1404 R. A. Long Building. The new office will be under the charge of R. C. Clifford, formerly of the St. Louis office of this company.

Mainly Constructional

East and West From Coast to Coast

The City Council of Berlin, Ont., have decided to engage a competent engineer to report on the trunk sewer and to determine whether or not the construction is faulty.

Over $240,000 was spent by the city of Hamilton on road work under the local improvement plan last year. Sewer construction took $41,600, and $145,400 was spent on the construction of sidewalks and curbs. In few cases were the actual costs in excess of the estimates.

With capital stock of $40,000, Granite Concrete Block Company, Limited, have been incorporated at Toronto by J. A. Livingston, R. Robinson, M. Robinson, and V. M. Livingston. The company will manufacture and deal in cement block, burial vaults and other cement products.

The plant of the Union Cement Company at Brooks, near Owen Sound, Ont., began its season's operations last week. The company have completed alterations to the plant which will render the production more economical, and they expect a full season's run, in spite of the apparent trade depression now existing.

The Bowmanville Gravel Company, Limited, has been incorporated at Bowmanville, Ont. The provisional directors of the company are J. T. Marsh, A. C. MacNaughton, C. W. Livingston, and A. L. Shaver, and the company will deal in gravel, sand, crushed stone and other builders' supplies. The capital stock is $40,000.

P. O'Donnell, H. J. McNinley, M. D. Albert, J. McFeetors, and G. E. Buchanan have incorporated The New Ontario Concrete Building and Construction Company, Limited, at Sudbury, Ont. The capital stock is $40,000 and the firm will carry on a general contracting business and manufacture concrete blocks, bricks and pipes.

A party of business men and property owners of the town of Ingersoll, Ont., paid a visit of inspection to Aylmer last week, and gave special attention to the permanent brick and concrete roads of that town. The town of Ingersoll is seeking information on the paving question, and the visitors were favorably impressed with Aylmer's brick streets.

Messrs. Ewing, Lovelace and Tremblay, of Montreal, are making a complete survey, plan and levels of the town of Greenfield Park, Que., on the south side of the St. Lawrence, opposite Montreal. The officials have commenced a town planning scheme, and the data to be furnished is partly in connection with this scheme, and partly for the purpose of public improvements.

The first shipment of pipe sections for the new intake at Brockville, Ont., has just been placed on the job. It consists of eight 57-ft. lengths of 30-inch pipe, constructed of English seamless steel tubing. This material is practically unbreakable, and is far superior to the old cast iron pipe. The joints of the intake will be covered with concrete anchored to the bottom. Seven hundred feet of the new intake will extend under water and 150 feet will be on land.

During the present year the Montreal Harbor Commissioners will expend $2,000,000, of which $800,000 will be on the addition to No. 1 elevator, making that structure the largest elevator at any Atlantic seaport. The other work includes dredging of the south shore channel, the material being used for the construction of wharves; the building of a concrete roadway on the south shore, the extension of piers, the construction of berths, and the extension of the harbor railway system.

One of the largest contracts in the Province of Quebec this year, the Quebec Central Station for the C. P. R. and Transcontinental Railway, has been let to the Downing-Cook Company, Limited, Montreal. The plans have been drawn up by Mr. H. E. Prindle, of Montreal. The station will be two storeys high, of granite and brick construction. The steel work will be supplied by the Eastern Canada Steel and Iron Works, Limited, while the piling will be on the pedestal pile system of the MacArthur Concrete Pile and Foundation Company, New York.

The Lord & Burnham Company, of Irvington-on-Hudson, N.Y., are about to commence operations in their new $100,000 factory at St. Catharines, Ont., where they will manufacture materials for greenhouses, such as they now manufacture at their United States plant. The new plant will have an annual output worth from $350,000 to $500,000. It is equipped with iron and woodworking machinery and will give employment to carpenters, painters and glaziers, as well as men of other trades. It is said that the company will offer no opportunities to American interests in supplying future equipment, except in open competition with Canadian dealers.

The stonework for the large new filter bed at the sewage disposal works at Regina, Sask., has been completed for some time, and the city is now awaiting the delivery of the steel trusses from the Regina Foundry before completing the building. All the other materials are said to be on the ground. The new bed, which is rectangular in shape, will have double the capacity of the four round filter beds previously constructed. If the experiments in aerated sewage which are being conducted at the present time by Mr. R. O. Wynne-Roberts at the old power house prove a success, it is more than likely that the city will be relieved of the expense of constructing any more of these costly filter beds.

Although the constructional business in Montreal is still quiet, there are signs of a slight improvement in several departments. Trade in the Province generally appears to be fairly good, and this, in a measure, is reflected in the turnover of city firms who have country customers. A few important contracts have been let recently, notably those for the joint station at Quebec; a bath at Maisonneuve; a college at Laval des Rapides; St. Michael's parish church, Montreal; crypt of the Oratoire St. Joseph du Mont Royal, Cote des Neiges; wing of the Royal Victoria Hospital, Montreal; St. Denis Theatre, Montreal; Bloomfield and Bancroft Schools, Montreal; and a number of smaller schools and churches in the Province.

The Aztec Oil and Asphalt Refining Company of Canada, Montreal, have made a proposal to the city of Montreal to construct a plant, at an approximate cost of $2,000,000, providing that the city will agree to buy asphalt for a term of ten years at $16.45 per ton. The company, who are connected with the Interocean Oil Company, of New York, propose to manufacture the various by-products in addition to the asphalt. The Council have also received tenders for the supply of asphaltic material, together with samples. Prices range from $14.27 to $32 per ton, the lower quotation representing a considerable saving on the price under the contract which has just expired. New specifications have been lately drawn up, and the twelve samples sent in were submitted to Messrs. Milton, Hersey and Crossley, Prof. French, of McGill, and Prof. Haynes, of Laval. These experts recommend the acceptance of the tender of Mr. J. Baker, Jr., of New York, at $14.27 per ton.

The town of Cartierville, P.Q., is about to install a system of water filtration, plans for which have been drawn up by Mr. H. G. Hunter, C. E., of the New York Continental Jewell Filtration Company, Montreal, under the instructions of Mr. F. C. Laberge, the Engineer. The plant, built of reinforced concrete, will have a capacity of a million gallons a day, and is to be on specifications by the New York Continental Jewell Filtration Company, Montreal. The water will be drawn from the Ottawa River, the intake pipe running about three hundred feet into the stream. The plant will be located about 150 feet from the bank of the river. The water will flow by gravity into the plant and will then be pumped into a reservoir about one thousand feet distant. The town has purchased the piping system of the Montreal Public Service Corporation, which now supplies the town with water. The plant will consist of three filter units having an area of 125 feet of sand surface, two coagulating basins with a combined capacity of approximately 136,000 U. S. gallons, and providing for a coagulation and subsidence period of three hours, and a clear water basin having a capacity of 65,000 U. S. gallons. The contract includes the provision of a complete system of coagulation and hypochlorite of lime solution mixing and feeding apparatus. The pumping plant will consist of a low-lift motor-driven centrifugal pump, and a high-lift gasoline engine-driven centrifugal pump, each having a capacity of 700 U. S. gallons per minute. A rotary pressure blower will be geared to an alternating current motor.

Trade Inquiries

The Weekly Report of the Department of Trade and Commerce contains the following inquiries relating to Canadian trade. The names and addresses of the firms making these inquiries can be obtained by those specially interested in the respective commodities upon application to the Inquiries Branch, Department of Trade and Commerce, Ottawa:

621. **Heating apparatus.**—Catalogues and price lists of furnaces are desired by a Paris broker from Canadian manufacturers.

636. **Building material.**—A Paris concern desires quotations on every kind of building material, c.i.f. French port.

660. **Railway sleepers, telegraph poles and other lumber.**—A firm in Dundee desires the addresses of British Columbia manufacturers of railway sleepers, telegraph poles, and other lumber.

661. **Steel and iron.**—A Nottingham firm inquires for sections and joists in quantities. Contracts for 100 tons.

662. **Rolled steel joists.**—A Loughborough firm using approximately 5,000 tons of above per annum, in British Standard sections ranging from 5-inch by 3-inch to 24-inch by 7½-inch, to British Standard specification, is open to receive quotations from Canadian manufacturers.

663. **Steel and iron sectional materials.**—A Stoke-on-Trent firm is open to receive quotations for above, such as flats, angles, channels, etc.

665. **Steel.**—An Ipswich firm inquires for quotations on steel joists, angles, tees and flat steel in good quality steel.

666. **Steel.**—A firm in Leicester is open to receive quotations for steel joists, sections and plates.

667. **Steel channels.**—A Leicester firm inquires for manufacturers of 8, 10 and 12 inch channels, lengths up to about 36 feet. Also round mild steel bars up to 4 inches diameter rising by lengths and quarters and above 4 inches up to 6 inches or 7 inches rising by half inches.

669. **Steel.**—A Birmingham firm inquires for exporters of the following steel. Prices to be c.i.f. Liverpool, Birkenhead, Manchester, or c.i.f. their works—James Bridge Works, Darlaston. Steel to be British Standard specification for general building construction, as revised August, 1912, and to be well and cleanly rolled. Joists to be cold straightened in the usual way: Five tons joists, 5 by 3 by 11 pounds, in 12 to 20-foot lengths; 10 tons joists, 8 by 4 by 18 pounds, in 16 to 24-foot lengths; 10 joists, 12 by 5 by 32 pounds, 20 feet long (B.9); 10 joists, 12 by 5 by 32 pounds, 22 feet long (B.9); 10 joists 12 by 5 by 32 pounds, 24 feet long (B.9); 5 tons flats, 2½ by ⅜ inch, 20-foot lengths; 5 tons flats, 3 by ⅜ inch, 20-foot lengths; 5 tons flats, 3 by ½ inch, 20-foot lengths; 5 tons flats, 3½ by ⅜ inch, 20-foot lengths; 5 tons flats, 3½ by ½ inch, 20-foot lengths; 5 tons flats, 4 by ⅜ inch, 20-foot lengths.

The Charm of Quebec and the Maritimes

With the approach of summer there are many who are beginning to turn their thoughts to the annual holiday. With the pleasure grounds of Europe cut off from Canada and the United States, it is fair to assume that Canada will receive more attention as a holiday ground than ever before. For this reason the Canadian Government Railways (Intercolonial Railway and Prince Edward Island Railway) are to be congratulated upon the publication of a number of interesting booklets which set forth the charms of Eastern Canada. These booklets, which are well illustrated, contain full information as to railway and hotel rates; but, apart from this, they are informative and well worthy of the perusal of those who believe in "seeing Canada first."

Here is a tribute to Eastern Canada contained in one of the publications:

> A glorious summer country is Eastern Canada—a country which lies by the sea and is fanned by cooling breezes from the ocean. In this land are green hills, shady groves and fertile valleys. From the mountains the crystal brooks come leaping with the music of gladness, and join with the noble rivers in whose clear waters dwell lordly salmon and scarce less lordly trout. Near at hand are forests, as yet so little disturbed that the moose and deer, now and again, wander close to the farmyards of the adjacent settlements, and gaze in bewildered surprise at the man whose hand is raised to slay them. Along the shore for hundreds of miles lie land-locked harbors, where even the frail bark canoe may float in safety, yet be upon the waters of the ocean, and from the smooth sand beaches a child may venture into the buoyant salt water and fear not. In this country is scenery at times of sweet pastoral simplicity, at times of sublime grandeur. It is a land where civilization has made its way, and yet not marred the beauty of nature. It is a country where the traveller will find much that is novel, much that will charm, and much that will ever remain to him as a sweet remembrance of a pleasant clime.

One of these publications, "Summer Provinces by the Sea," is a book of over two hundred pages, which describes graphically the scenic features along the whole road of the Canadian Government Railways. Another is "La Baie de Chaleur," which sets forth the charms of this estuary of the Restigouche. Another is "Abegweit" (cradled on the waves)—a fine tribute to the attractions of Prince Edward Island. Another describes the scenic grandeur of Cape Breton Island.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Berlin, Ont.
City Clerk A. H. Millar will receive tenders until June 3rd for the construction of about 2,000 square yards of pavement. Alternative tenders are required on asphalt, bitulithic, and vitrified brick. Plans at office of City Engineer, H. Johnston.

Brussels, Ont.
The Village Engineer, John Roger, Mitchell, Ont., has been instructed to prepare plans for a permanent roadway and curbing. Clerk, T. S. Scott.

Tenders will be received until June 15th by the Village Clerk, F. S. Scott, for the construction of paving and curbing on Main Street. Plans and specifications at offices of Engineer, John Roger, Mitchell, and of the Clerk.

Cayuga, Ont.
Tenders on the construction of reinforced concrete pavement will be received until June 7th by J. W. Sheppard, Village Clerk. Plans and specifications at offices of Jackson & Company, Engineers, Temple Building, Brantford, and the Clerk.

Chatham, Ont.
Tenders will be received until June 8th by Joseph Gosnell, Clerk of Kent County Council, or Adams & Adams, Engineers, News Building, for the construction of a watermain from Emma Street to County House of Refuge.

Chatham Township, Ont.
The Township Council have had plans prepared for pumping and drainage systems. Engineer, W. G. McGeorge, 153 Queen Street, Chatham.

Hull, Que.
A by-law has been passed providing for the extension and enlargement of the watermains throughout the town. Approximate cost, $100,000. Engineer, J. A. Laforest.

Ingersoll, Ont.
The Town Council have decided to lay brick pavement on cement foundation on Thames Street, and plans for this work will be prepared. Clerk, W. R. Smith.

London, Ont.
Tenders will be received until 4 p.m., June 9th, by the City Clerk, Samuel Baker, for the construction of approximately 18,000 square yards of asphalt pavement on concrete base, 1,900 feet of 10-inch main sewers, and 2,200 feet of 6-inch private connections. Plans, etc., at office of City Engineer H. A. Brazier.

Mariposa Township, Ont.
The Township Engineer, A. G. Cavana, Orillia, will receive tenders until 2 p.m., June 7th, for the excavation and completion of a drain. Plans and specification at offices of Township Clerk, J. B. Weldon, Oakwood, and of the Engineer.

Marmora, Ont.
The Village Council are considering the installation of a water pipe system for fire fighting purposes. Estimated cost, $10,000. Clerk, H. W. Sabine.

Niagara Falls, Ont.
The City Council will call for tenders shortly on the supply of cement for paving on Robert Street. Clerk, W. J. Seymour.

Tenders will be called for shortly by the City Council for the construction of brick paving on Queen Street. Engineer, F. J. Anderson. Approximate cost, $16,000.

Orillia, Ont.
Tenders for the construction of sewers will be received until June 4th by C. E. Grant, Town Clerk. Plans and specifications at office of City Engineer, J. S. Blickensderfer, and of the Clerk.

Peterboro, Ont.
The City Council are receiving tenders on the construction of concrete, asphaltic concrete and bitulithic pavement on various streets. Engineer, R. H. Parsons.

St. John, N.B.
A quantity of 36-inch water main will be purchased by R. W. Wigmore, Commissioner for Water and Sewerage.

Stratford, Ont.
The City Council have decided to use lock joint sewer pipe in the construction of the projected main sewer. Engineer, A. B. Manson.

The City Council have passed a by-law to authorize the borrowing of $50,000 for the installation of a gasoline pumping plant and a water tower, 145 feet high, with a capacity of 500,000 gallons. Tenders will be called for by the Hydro-Electric Commissioners, Continental Life Building, Toronto.

Tenders for the construction of an elevated water tower of 500,000 Imperial gallons capacity will be received until June 25th by Ontario Hydro-Electric Power Commission, Continental Life Building, Toronto. Specifications and forms of tender with F. A. Gaby, Chief Engineer, care of Commission.

Windsor, Ont.
The City Council contemplate laying about 7 miles of watermains, varying between 6-inch and 20-inch in size. Secretary, W. A. Hanrahan.

Winnipeg, Man.
Tenders will be received until June 4th by M. Peterson, Secretary to Board of Control, for the supply of sewer pipe and specials. Plans and specifications at office of Engineer, W. P. Brereton, 223 James Avenue.

CONTRACTS AWARDED

London, Ont.
The City Council have let contracts for the construction of sewers to the following firms:—Connolly-Agnew Construction Company, 606 Avenue Road, Toronto, $38,900; W. McCracken, London, $5,500; Webster Construction Company.

Toronto, Ont.
The Board of Control have awarded the following contracts:—asphalt paving on Wellington Street West, to Commissioner of Works, R. C. Harris, City Hall, at $18,797; asphalt paving on St. Nicholas Street to Godson Contracting Company, Manning Chambers, at $1,165; concrete curbs on Wellington Street to Standard Concrete Paving Company, 18 Carey Road.

The contract for the construction of Argyle Street storm overflow sewer, Section No. 3, has been awarded by the Board of Control to Orpen Company, Limited, 165 King Street W., at $44,000.

Vercheres, Que.
The general contract for the erection of a bridge has been let by the Municipal Council to J. Trudeau & J. E. Messier, Varennes, Que. Approximate cost, $3,000.

Westmount, Que.
A contract for asphalt paving has been let by the City Council to Warner-Quinlan Asphalt Company, 745 St. Catherine Street W., Montreal.

Railroads, Bridges and Wharves

Blanshard Township, Ont.
Tenders will be received until June 7th by the Township Clerk, J. H. Q. Jamieson, R. R. No. 6, St. Mary's, Ont., for work on two bridges on Base Line. Work to consist of painting abutments and the construction of cement flooring.

Broadview, Sask.
Tenders will be called for shortly for the construction of a subway at Ninth Avenue and Front Street for the C. P. R. Engineer, J. C. Holden, Divisional Engineer, Winnipeg. Approximate cost, $65,000.

Cape Breton, N.S.
Tenders will be received until June 8th by J. W. Pugsley, Department of Railroads and Canals, Ottawa, for the construction of eight bridges on main line of Intercolonial Railway, Sydney Sub-Division. Plans and specifications at offices of Chief Engineer, Moncton, N.B., Resident Engineer, Glasgow, N.S., and the Secretary, Ottawa. Reinforced concrete construction.

Lorne Township, Man.
Tenders for the construction of seven or eight tile and timber bridges will be received until June 5th by Damien Labossiere, Municipal Office, Somerset, Man. Plans and specifications with Mr. Labossiere, and at Public Works Department, Winnipeg.

Milton, Ont.
Tenders for the construction of a ce-

ment bridge on Woodward Avenue will be received until June 5th by G. A. Hemstreet, Milton West. Plans and specifications with Mr. Hemstreet.

Onondaga Township, Ont.
Tenders will be received until June 7th by Alfred Burrill, R. R. No. 2, Cainsville, for the construction of two bridges and one concrete arch, to be built under supervision of Onondaga Council. Specifications at office of A. B. Rose, Cainsville.

CONTRACTS AWARDED

Manitou, Man.
In connection with the bridge being constructed for the Hudson Bay Railroad Company, Fort Garry Sourt, Winnipeg, the contract for concrete work has been let to J. D. McArthur Company, 501 McArthur Building, Winnipeg.

St. Redempteur, Que.
The general contract for the construction of a bridge has been let by the Municipal Council to George Seguin, Rigaud, County Vaudreuil. Concrete and steel construction, pipe railing. Approximate cost, $4,500.

Valleyfield, Que.
The Department of Railways and Canals, Ottawa, have let the contract for construction of works for the protection of the dam to Carlton Construction Company, Limited, Union Bank Building, Ottawa.

Public Buildings, Churches and Schools

Drumbo, Ont.
Interior fittings for the Presbyterian Church here will be purchased by the Building Committee. Chairman, J. D. Cowan.

Edmonton, Alta.
Funds are being raised for the erection of a church here. Particulars from Rev. D. G. McQueen, 408 Fourth Street.

Fort Garry, Man.
The Municipality will call for tenders shortly on the construction of a Town Hall. Architect, D. R. Baribault, 11 Bank d'Hochelaga, Winnipeg. Approximate cost, $5,000.

Marmora, Ont.
G. B. Airhart, Secretary to Public School Board, will receive tenders until June 4th for rebuilding the public school. Plans and specifications with Secretary.

Red Jacket, Sask.
Tenders will be received until June 10th by G. Burden, Secretary-Treasurer to School District No. 132, Mossomin, for the construction of a frame school four miles north of Red Jacket. Architects, Waterman & Waterbury, Donahue Block, Regina.

Toronto, Ont.
The Board of Education will receive tenders until June 8th for the construction of concrete sidewalks in the grounds of the Technical School, Lippincott Street. Plans at office of Ross & Macdonald, Architects, 908 Royal Bank Building.

It has been decided to have an iron fence erected around the grounds of the Technical School, Lippincott Street. Secretary-Treasurer to Board of Education, W. C. Wilkinson, City Hall.

CONTRACTS AWARDED

Atwood, Ont.
The masonry and plastering contract in connection with the erection of the Methodist Church here has been awarded to J. Smith, Milverton, and the contract for seating to Globe Furniture Company, Limited, Waterloo.

Gravenhurst, Ont.
The general contract for an extension to the fire hall has been let by the Town Council to Eller & Clift. Brick construction.

Jeannette's Creek, Ont.
The general contract for the erection of a school has been let by the School Board to John Magee, 11 Patterson Avenue, Chatham, and W. H. Draper, Adelaide Street, Chatham. Concrete foundation, brick construction, shingle roofing. Approximate cost, $4,000.

London West, Ont.
The general contract for the erection of a school on Charles Street has been awarded by the Board of Education to L. H. Martyn & Company, 807 Princess Avenue, at $5,700.

Montreal, Que.
The contract for seating for St. Charles Roman Catholic Church, 401 Centre Street, has been let to Paul Dewers, 115 Van Horne Avenue.

In connection with repairs to the Court House the contract for electric wiring has been let to Peerless Lighting Company, 319 St. Lawrence Boulevard. Plastering, painting and roofing contracts will be let shortly.

Work has been started on repairs to the West End Methodist Church by Horatio Barr, 21 Coursol Street. Approximate cost, $9,000.

In connection with the presbytery being erected on St. Hubert Street for the Parish St. Rosaire, the following contracts have been let:—masonry and carpentry, A. Filion & Frere, 2419 St. Denis Street; plumbing and roofing, J. E. Hardy, 666 Papineau Avenue; painting, C. Larin, 468 Park Lafontaine; electrical work, J. A. St. Amour, 2171 St. Denis Street.

Niagara Falls, Ont.
In connection with repairs and alterations to the Collegiate Institute the contract for carpentry has been awarded to Boyd, Roszel & Graham, the painting contract to L. C. Biggar, 5 Cookman Avenue, the plumbing contract to Payne & Nesbitt, and the contract for electrical work to Carter Electric Company, Erie Avenue.

Oakwood, Ont.
The general contract for the erection of a school in Section No. 7, Mariposa, has been let to R. Morrow & Son, Woodville, Ont. All material for heating, ventilation, and sanitary closets will be purchased by the School Board. Secretary, A. J. Mark, Oakwood.

Quebec, Que.
The contract for roofing in connection with the presbytery being built on Charlesbourg Road for Parish of St. Francois d'Assise has been awarded to V. Gauvin, Limoilou, the painting contract to J. M. Tardivel, 4 Cote D'Abraham Street, and the heating, plumbing, and electrical contract to A. Noreau, 5th Avenue, Domaine Lairet.

Richmond, Ont.
The general contract for the erection of a mission hall for the Roman Catholic congregation has been let to P. Ellement, 624 Cooper Street, Ottawa. Frame and stucco construction.

St. Thomas, Ont.
The contract for the construction of a school in Section No. 2 has been awarded to H. Smale, Sparta P. O., at $3,600.

Business Buildings and Industrial Plants

Brussels, Ont.
Pryne & Son are about to construct a feed mill, and are in the market for material. Concrete construction. Work by day labor.

Goderich, Ont.
A by-law has been carried to exempt the North American Chemical Company from all except school taxes for ten years, in connection with the projected addition to their salt factory. Manager, John Ransford, Clinton, Ont.

Hamilton, Ont.
Plans have been drawn for a store and residence to be erected on Kenilworth Street by Deeley & Dodgson, 106 Barnsdale Street, at an approximate cost of $4,500. Onwers will sub-let plastering, painting, heating, plumbing, and electrical work.

Levis, Que.
The Intercolonial Railway Company will receive tenders until June 25th for the construction of freight sheds here. Brick and steel construction. General Manager, F. P. Gutelius, Moncton, N.B.

Montreal, Que.
Work has been started by T. Trudeau, 2410 Hutchison Street, on the erection of stores and flats on Bernard Street. Estimated cost, $8,000.

Moose Jaw, Sask.
Tenders will be called for shortly by C. C. McAlpine, Architect, Willard Hotel, for alterations to a moving picture theatre on High Street E. for Dr. D. S. Howden, 4 High Street E. New flooring and front and about 200 theatre chairs will be required. Approximate cost, $4,000.

Niagara Falls, Ont.
James Williams, Riverway, Niagara Falls, N.Y., has prepared plans for a garage to be erected on Bridge Street at an estimated cost of $8,000. Concrete construction, composition paper roofing.

Ottawa, Ont.
M. Landreville, Albert Street, is about to commence the erection of a garage, estimated to cost $20,000. Heating, plumbing and electrical work will probably be sub-let. Architect, W. H. George, Castle Building, Queen Street.

Taylor & Lackey, 21 First Avenue, are in the market for steel columns and beams required for alterations to a store for L. N. Poulin, Limited, 156 Sparks Street.

Tenders will be received until June 4th by W. E. Noffke, Architect, Plaza Building, Rideau Street, for an addition to the store of R. E. Powell, 290 Elgin Street. Approximate cost, $5,000.

Prices are being received by K. Cohen, 105 Sweetland Avenue, for plastering, painting, plumbing and electrical work

(Continued on page 53)

Tenders and For Sale Department

Tenders Wanted

Sealed tenders will be received until Saturday noon, **June 5th**, for all trades in connection with the erection of Rectory, West Toronto. A marked cheque for 5 per cent. of tender must accompany same. Plans and specifications can be seen, and all other information obtained at office of

J. M. COWAN, Architect,
65 Adelaide St. East,
22 Toronto, Ont.

Mail Contract

Sealed tenders, addressed to the Postmaster General, will be received at Ottawa until noon, on **Friday, the 2nd of July, 1915**, for the conveyance of His Majesty's Mails, on a proposed Contract for four years, six times per week each way, Markham (via Box Grove and Cedar Grove) Rural Mail Route, from the Postmaster General's pleasure.

Printed notices containing further information as to conditions of proposed Contract may be seen and blank forms of Tender may be obtained at the Post Offices of Markham, Box Grove, Cedar Grove and at the office of the Post Office Inspector, Toronto.

A. SUTHERLAND,
Post Office Inspector.
Post Office Inspector's Office,
Toronto, May 19th, 1915.
52 A. 5M.-25-7-13 21-23

Department of the Naval Service

Tender for 30 Ton Steam Wharf Crane—Halifax Dockyard

Tenders addressed to the undersigned at Ottawa, and endorsed "Tender for Steam Wharf Crane, Halifax Dockyard," will be received up to noon of the **1st of July, 1915**, for the manufacture, supply and erection of a 30-ton Steam Wharf Crane, of the Derricking Jib Type, for the above mentioned Dockyard.

The tender should be accompanied by an accepted cheque in favor of the Deputy Minister of the Naval Service, on a chartered Canadian Bank, for $1,600, which cheque will be forfeited should the successful tenderer decline to enter into the contract as agreed, or fail to complete the work in accordance with the conditions of the contract and specification.

Representatives of firms desirous of tendering are to state in making application for specification, the name of the firm manufacturing and erecting the crane observing that sub-letting any portion of the contract is inadmissable.

The specification and conditions of contract may be seen at the office of The Consulting Naval Engineer, Ottawa.

Newspapers copying this advertisement without authority will not be paid for same.

The Department does not bind itself to accept the lowest or any tender.

G. J. DESBARATS,
Deputy Minister of the Naval Service.
Department of the Naval Service.
—79499. Ottawa, April 30th, 1915. 20-22

TENDERS

The Village of Brussels in the County of Huron, Ontario, are asking for tenders for street paving and curbing of the Main Street. Plans and specifications can be seen at office of John Roger, Engineer, Mitchel, Ont., or at the Clerk's office. Tenders received up to June 15th, 1915.

F. S. SCOTT,
22-23 Village Clerk.

Hydro Electric Power Commission of Ontario

CITY OF STRATFORD

(Ontario, Canada)

Waterworks Elevated Water Tower

Notice to Contractors

Specifications for a 500,000 Imperial gallon elevated water tower will be issued on **Friday, June 4th**, and sealed tenders, mailed to the undersigned, and marked "Tender for Stratford Elevated Water Tower," will be accepted until 9 a.m. on **Friday, June 25, 1915**. Copies of the above specifications, and form of tender, can be obtained from the address given below.

The lowest or any tender will not necessarily be accepted.

F. A. GABY,
Chief Engineer,

Hydro-Electric Power Commission of Ontario,
Continental Life Building,
Toronto, Ontario.

This advertisement will not be paid for if inserted without authority from the Commission.
22-23

Sealed tenders addressed to the undersigned, and endorsed "Tender for Supplying Coal for the Dominion Buildings," will be received at this office until 4 p.m., on **Thursday, June 17, 1915**, for the supply of coal for the Public Buildings throughout the Dominion.

Combined specification and form of tender can be obtained on application at this office and from the caretakers of the different Dominion Buildings.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so or fail to complete the contract. If the tender be not accepted the cheque will be returned.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, May 20, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—79876. 21-22

COUNTY OF HALDIMAND

Good Roads Committee

Tenders will be received for the construction of at least ten reinforced concrete highway bridges varying in span from 6 ft. to 32 ft., on or before the **14th of June, 1915**. Plans and specifications may be seen and forms of tender obtained at the office of the County Engineer, Dunnville, Ontario, any day after the **1st** of June, 1915. Tenders to be addressed to

Mr. BAIN, Chairman,
Good Roads Committee,
20-23 R. R. No. 1, South Cayuga, Ont.

Tenders for Travelling Crane

Tenders will be received by the undersigned, addressed to Chester S. Walters, Esq., Mayor, Chairman Board of Control, Hamilton, up to 5 o'clock p.m. on **Wednesday, June 16, 1915**, for the following:

One Ten-ton Travelling Crane, with all appurtenances for the hand operation of same, complete with block and tackle and the necessary transverse and longitudinal girders and supports.

Tenders must be on form supplied by the City Corporation. Specifications covering the above may be obtained on application to the City Engineer's Office, City Hall, Hamilton.

S. H. KENT,
City Clerk.
Hamilton, June 2, 1915. 22

Tenders for the Construction of the Strachan Ave. Bridge over the C. P. R. Tracks

Separate tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, June 15th, 1915**, as follows:

(a) For the concrete masonry substructure and concrete floor of the above mentioned bridge.

(b) For the supply and erection of steel superstructure of the above mentioned bridge.

Specifications and tender form may be obtained upon application at the office of the Railway & Bridge Section, Department of Works. City Hall, Toronto, on payment of ten dollars ($10.00), this sum to be refunded upon return of plans.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City by-law must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.
City Hall, Toronto,
May 27th, 1915. 22

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, June 11th, 1915

for

Enlargement Rosedale School, All Trades

Brick Playsheds, Winchester Street School

Drain Work, Annette Street School

Cabinet Work, Williamson Road School

Sundry Repair Work

Sale of Portable Buildings, Strathcona School

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding Four thousand dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. C. WILKINSON,
Secretary-Treasurer.
MILES VOKES,
Chairman of Committee. 22

The Quebec Streams Commission

Proposed Storage Dam on the St. Maurice River

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Storage Dam at La Loutre on the St. Maurice River," will be received at the office of The Quebec Streams Commission, Room 264, Parliament Building, Quebec, until **twelve o'clock on Tuesday, the 15th of June next, (1915).**

Plans and specifications can be seen on or after this date at the said office, or at the Quebec Streams Commission's office, Room 803, McGill Building, Montreal.

Parties tendering will be required to accept the fair wage schedule prepared or to be prepared by the Department of Labor of the Province of Quebec, which schedule will form part of the contract.

Tenderers are notified that tenders will not be considered unless made strictly in accordance with the printed forms.

An accepted bank cheque for the sum of One Hundred and Fifty Thousand Dollars ($150,000.00), made payable to the order of the Provincial Treasurer, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
O. LEFEBVRE,
Chief Engineer.
The Quebec Streams Commission,
Montreal, April 29th, 1915.

Newspapers inserting this advertisement without authority from the Commission, will not be paid for it. 20

Tenders for Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to 6 o'clock p.m. of **Friday, June 18th, 1915**, for the construction of a Reinforced Concrete Truss Bridge (40-ft. span) being the third bridge south of Brownhill over Toole's Creek on the boundary road between York and Ontario Counties opposite lot 27 East Guillimbury, York County, known as Toole's Bridge.

Plans and specifications and all information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Engineer.
Toronto, June 1, 1915. 22

TOWN OF BURLINGTON

PROVINCE OF ONTARIO

Tenders for Sewerage Works

Sealed tenders will be received by the Town Clerk until 8 p.m. on **Tuesday, June 15th, 1915**, for the following works:—

Contract "A"—Labor laying sanitary and storm sewers sub-divided into eight contracts.
Contract "P"—Constructing Sewage Pumping Station.
Contract "S"—Furnishing Sewer Pipes.
Contract "X"—Constructing Sewage Disposal Works.

Plans and specifications may be seen at the Engineer's Office, Mail Building, Toronto, or at the office of the Town Clerk, Burlington on and after June 1st.

The lowest or any tender not necessarily accepted.

M. C. SMITH, Esq., Mayor.
JAS. C. ALLEN, Esq., Town Clerk.
CHIPMAN & POWER, Engineers.
Toronto, May 24th, 1915. 22

Board of Education

New Central Technical School

The Advisory Industrial Committee of the Board of Education, Toronto, will receive sealed tenders, addressed to the Secretary-Treasurer, on or before

Tuesday, June 8th, 1915, for

Concrete Sidewalks—Grading and Seeding of the Grounds

Plans and specifications may be seen on and after Friday, the 28th inst., at the offices of the Architects, Messrs. Ross and Macdonald, 908 Royal Bank Building. Each tender must be accompanied by a certified cheque of five per cent. of the amount of the tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by a Surety Company. Tenders must be in the hands of the Secretary-Treasurer, at his office in the City Hall, **not later than 4 o'clock p.m.**, on the date mentioned, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. C. WILKINSON,
Secretary-Treasurer.
RHYS D. FAIRBAIRN,
22 Chairman of Committee.

FOR SALE

A Bargain, Parsons Trenching Machine almost new. Digs to twenty feet deep and up to five feet wide. Box 196, Contract Record, Toronto.
2, 2

FOR SALE

Concrete Mixer, 12 ft. cap. "The Standard" Low Charging on truck, with high-grade gasoline engine, complete. New; never been used. In stock at Montreal. Extra low price. Write for particulars. The Standard Scale & Supply Company, 1345-47 Wabash Ave., Chicago, U.S.A.
19-22

Business Opportunity

Will sell Canadian patent rights Baltzer System of constructing inexpensive concrete houses. Only successful system of kind. Most comfortable, durable, attractive, 5-room houses built. Simple apparatus. System has fully demonstrated its worth in the United States. Approved by Government. Write for details immediately.

AUGUST BALTZER,
Severance Building,
21-24 Los Angeles, Cal.

Business Buildings and Industrial Plants

(Continued from page 51)

in connection with stores and apartments being erected on Somerset Street E.

Regina, Sask.
The North-West Lumber & Supply Company, Eighth and Ottawa Streets, have commenced the erection of a building, estimated to cost $3,000. Galvanized iron construction.

Toronto, Ont.
William Davis, 3 Scarboro Road, has commenced the erection of a store at Queen Street and Scarboro Road. Brick construction, tar and gravel roofing. Estimated cost, $3,000.

CONTRACTS AWARDED

Bedford, Que.
The plumbing contract in connection with the factory being built for the Bedford Manufacturing Company, Bridge Street, has been awarded to M. Knight, Limited, 91 Inspector Street, Montreal. All other work to be done by general contractor.

Toronto, Ont.
Work has been started by W. B. Charlton, 412 Indian Road, on the construction of a factory at 1152-1154 Dundas Street, for the Le Page Individual Communion Cup Company, 102 Tyndall Avenue. Smaller trades will be sub-let. Stone and brick construction, tar and gravel roofing. Estimated cost, $25,000.

Residences

Charlottetown, P.E.I.
Work has been started by day labor on the erection of a residence on Brighton Street for Ivan Reddin, c/o Reddin Bros. Architect, J. M. Hunter, Morris Block. Approximate cost, $6,000.

Dundas, Ont.
Work has been started on the erection of a residence by David Craig. Owner will receive tenders on all trades excepting brick work and plastering. Estimated cost, $3,500.

London, Ont.

A residence is being erected on Wortley Road for T. G. Dockstader, Queens Avenue, by John Hayman & Sons, 432 Wellington Street. Brick construction, concrete foundation, shingle roofing. Approximate cost, $3,700.

Maisonneuve, Que.

Henry Bernier, 758 Adam Street, has commenced the erection of a brick veneer residence. Approximate cost, $7,000.

Work has been started on the erection of a residence by J. Rheaume, 907 Desjardins Street. Estimated cost, $5,000.

Ojibway, Ont.

Plans for a residence are being prepared for Amede Gignac by Leybourne & Sewell, Sandwich Street, Windsor. Work by day labor. Brick construction, concrete foundation, shingle roofing. Approximate cost, $6,500

Ottawa, Ont.

A. S. Quinn, 94 Fairmont Street, has commenced the erection of a residence. Stone foundations, brick veneer construction, shingle roofing. Estimated cost, $4,500.

Charles Holbrook & Son, 425 Somerset Street, have commenced the erection of alterations and additions to a house for apartments. Brick veneer construction, shingle roofing. Estimated cost, $20,000.

Frank Bossie, 452 Laurier Avenue W., has commenced the erection of apartments on Laurier Avenue by day labor. Heating, plumbing and electrical work will be let. Estimated cost, $10,000.

W. E. Noffke, Architect, Plaza Building, Rideau Street, will call for tenders shortly on the erection of a residence on Clemow Street for J. Beech. Brick construction, stone foundation, tile roofing.

Tenders will be received by Millson & Burgess, Architects, Union Bank Building, for the conversion of premises on Laurier Avenue into apartments for Dr. J. Lorne Graham, 202 Laurier Avenue W. Estimated cost, $9,000.

Quebec, Que.

Work has been started on the construction of a frame and brick residence by J. Letourneau, 172 Ste. Marguerite Street. Approximate cost, $5,000.

Ernest Rochette, 71 Des Stigmates Street, has commenced the erection of a residence on Bourlamarque Street by day labor. Smaller trades will be sub-let. Approximate cost, $10,000.

Work has been commenced on the erection of a residence at Fourth Street and Fifth Avenue by Albert Lapointe, 74 Sixth Avenue, Limoilou. Frame and brick construction, stone foundation, felt and gravel roofing. Estimated cost, $6,000.

Toronto, Ont.

L. H. Lankin, 124 Hampton Avenue, is building a pair of residences at 603-605 Jones Avenue. Brick construction, shingle roofing. Estimated cost, $3,000.

Plans have been drawn for a pair of residences to be erected at 133-135 Greenwood Avenue for C. E. Walton, 100 Gerrard Street E. Brick construction, shingle, felt and gravel roofing. Approximate cost, $3,000.

Dr. J. J. Matheson, 1279 Dundas Street, is receiving tenders on all trades except masonry required in the erection of a residence at Dundas and Etna Streets. Approximate cost, $5,000.

W. Stollery, 20 Elgin Avenue, has commenced the erection of a residence on Keele Street, estimated to cost $4,500. Brick construction, shingle roofing.

Tenders for wiring two residences at Edna Street and Indian Road are being received by McIlroy & Lowry, 105 Clendennan Avenue.

Westboro, Ont.

A residence is being built on Golden Avenue by R. E. Ralphs. Brick veneer construction. Approximate cost, $4,000.

CONTRACTS AWARDED

Hamilton, Ont.

The general contract, masonry, carpentry, steel, roofing, plumbing and painting contracts in connection with the erection of a residence on Leinster Avenue for L. B. Johnston have been let to F. D. Barnes, 90 Jackson Street W. Estimated cost, $3,000.

London, Ont.

Harry Hayman, 491 Ontario Street, is building a residence for J. W. Metherall, Queens Avenue. Brick veneer construction. Approximate cost, $3,000.

Work has been started by M. J. Morrison, Dundas Street E., on the erection of a residence on Elizabeth Street for George Burdick, 634 Dundas Street. Brick veneer construction. Approximate cost, $9,000.

The general contract for the erection of a residence on Wortley Road for Dr. R. Ferguson, 141 Wortley Road, has been awarded to G Stark, 41 Ridout Street. Smaller trades will be sub-let by general contractor. Approximate cost, $4,500.

E. Harley Tennent, 456 Ridout Street, has let the contract for the erection of a brick residence at 69 Fullerton Street to W. Metcalf, Wharncliffe Road. Estimated cost, $3,400.

In connection with the residence being built on Richmond Street for A. E. Neil, 1051 Richmond Street, the general contract and masonry contract have been let to Northey & Tullett, 825 Dufferin Street, and the carpentry contract to S. Fenwick, Langarth Street.

Montreal, Que.

The painting contract in connection with the flats being erected on Garnier Street for L. Deslauriers, 496 Fabre Street, has been let to R. Forget, 491 Fabre Street, and the heating and plumbing contract to J. Lafrancois, Chambord Street.

North Bay, Ont.

The general contract for the erection of a residence for Dr. D. A. Campbell, Campbell Block, has been awarded to J. J. O'Neil, North Bay. Plumbing, heating and wiring contracts not yet let.

Ottawa, Ont.

The general contract for alteration to a residence on James Street for P. J. Powers, 432 Well9ington Street, has been awarded to A. Boehmer, 280 Creighton Street, and the plastering contract to Murphy & Morrow, 139 Waverley Street. Estimated cost, $6,000.

Miss S. M. O'Grady, has awarded the contract for alterations to a residence on Gloucester Street for apartments to A. Christie & Son, 359 Elgin Street. Brick construction, stone foundation, felt and gravel roofing. Approximate cost, $7,000.

George Eaman & Son, Isabella Street, have been awarded the contract for the erection of a residence on Allan Place for R. B. McDougall. Brick construction, stone foundation, shingle roofing. Estimated cost, $9,000.

Preston, Ont.

The masonry contract in connection with the erection of a residence on Duke Street for John Brill has been let to Wirsching Bros., Duke Street, and for carpentry work to James Eagle, Hamilton Street. Estimated cost, $4,000.

Quebec, Que.

The masonry contract in connection with the residence being built on Avenue des Erables for E. Morisette, 208 Latournelle Street, has been let to A. Frenette. Sub-contracts for other trades will be let.

G. J. Belanger, 1 Second Street, is building a residence on Third Avenue at an estimated cost of $5,000. Frame and brick construction, metal and asbestos roofing.

N. Moisan, 23 D'Artigny Street, has awarded the general contract and carpentry contract for the erection of a residence to Lavoie & Frere, 52 Jeanne D'Arc Street. Concrete foundation, brick construction, felt and gravel roofing. Approximate cost, $5,000.

St. Hyacinthe, Que.

The general contract for the construction of a residence for J. A. Boisseau has been awarded to Lumber & Construction Company, Limited, Ville Street, Pierre, Que. Approximate cost, $7,000.

Toronto, Ont.

The masonry contract in connection with the residence being built on Melgund Road for R. A. Shields, 121 Hilton Avenue, has been awarded to Alfred Clare, 75 Arlington Avenue. Other trades not yet let. Estimated cost, $4,500.

The contract for plastering in connection with the residence being built for R. W. Hannah, 118 Silver Birch Avenue, has been awarded to Nelson & Matthews, 425 Clinton Street, the contract for plumbing to L. C. Webster, 278 Broadview Avenue, and the painting contract to Bromley & Hackett, 30 Afton Avenue. Heating contract not awarded.

The plastering contract in connection with the residence being erected on Kingswood Road by A. L. Dufty, 218 Balsam Avenue, has been let to E. Burridge, 395 Woodbine Avenue.

Wilton Grove, Ont.

The general contract for the construction of a residence has been let by J. Crinklaw, R. R. No. 2, Wilton Grove, to Turner Bros., Belmont Ont. Estimated cost, $3,000.

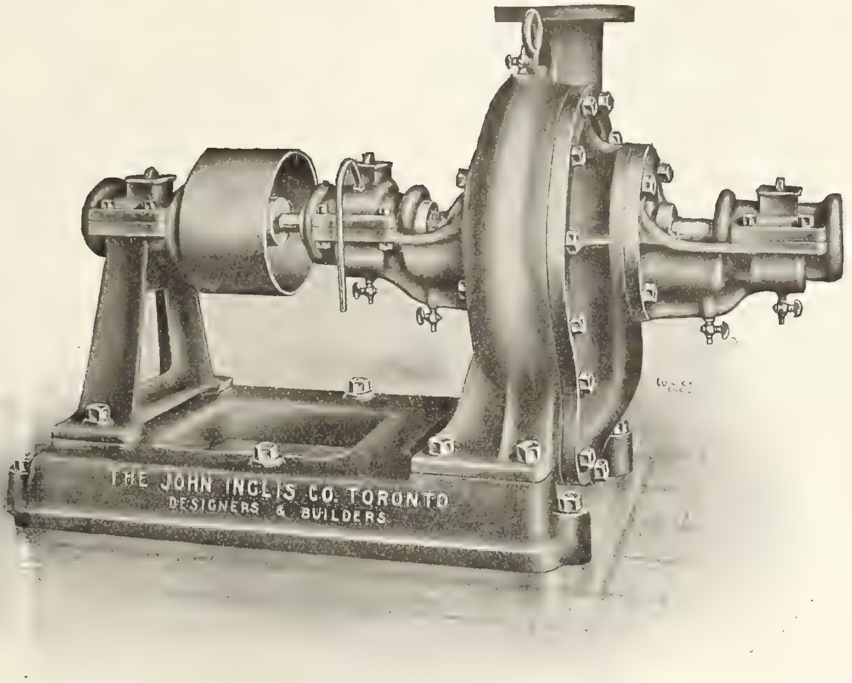
Power Plants, Electricity and Telephones

Craik, Sask.

The Fargo Rural Telephone Company have been empowered to borrow $3,000 for the construction of a telephone system. Secretary, David, Walsh, Craik.

Power to borrow $4,500 for the construction of a telephone system has been granted the Bennett Rural Telephone Company. Secretary-Treasurer, L. M. Bennett, Craik.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

INGLIS' PRODUCTS ARE "MADE IN CANADA"

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Montreal Office: Room 509 Canadian Express Building
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Galt, Ont.
Plans are being prepared for the electrification of the Lake Erie & Northern Railroad, between Galt and Brantford. Manager, Martin L. Todd, care of Company, East River Road, Galt.

Hull, Que.
Tenders will be received until 4 p.m., June 7th, by City Clerk H. Boulay for the supply of the following equipment:—one waterwheel, 1,200 h.p., and governor; one set of double helical gears; one electric generator, 600 kw., 2,200 volts, 2-phase, 60-cycle; one centrifugal pump, 5,500 Imperial gallons p.m., under 280 feet head; all other necessary appliances, meter gauges, piping, switchboards, transformers, starters, etc. Specifications at office of City Engineer, J. P. Laforest.

Nanaimo, B.C.
The B. C. Telephone Company, Bastion Street, Nanaimo, and 55 Seymour Street, Vancouver, contemplate laying 600-pair, 200-pair, 100-pair, and 50-pair cables.

New Liverpool, Que.
The Village Council contemplate the installation of an electric lighting system. Commissioner, J. Hamelin.

North Vancouver, B.C.
The City Council have authorized Supenintendent Hurd of the North Vancouver Ferry Company, Columbia Street, Vancouver, to purchase one 7½ kw. dynamo and other equipment for lighting the ferry wharf and buildings on Lonsdale Avenue.

Fires

Barnston Township, Que.
A sawmill belonging to W. K. Baldwin, Baldwin's Mills, Que., has been totally destroyed by fire. Owner will rebuild at once. Mill construction, shingle roofing. Belts, shafting and machinery will be required.

Parrsboro, N.S.
Fire has destroyed the American House, Eastern Avenue and Main Street. The proprietor, Robert Smith, carried small insurance.

St. Jerome, Que.
A sawmill belonging to Rodrigue Deschambault has been destroyed by fire, with a loss of $10,000, covered by insurance. Owner will rebuild and is in the market for machinery.

Waterdown, Ont.
Fire has destroyed the Post Office, Public Library and a store belonging to F. W. Walling, and damaged A. E. Alton's barber shop. Loss, $25,000.

Miscellaneous

Bassano, Alta.
Tenders will be received until June 19th by the Town Clerk, G. B. R. Bond, for the supply of one 750-gallon turbine waterworks pump. Plans with Clerk.

Charlottetown, P.E.I.
The City Council are receiving prices on an auto hose truck with chemical tanks. Clerk, W. W. Clarke.

Halifax, N.S.
Tenders will be received until July 1st by the Department of Naval Service, Ottawa, for the manufacture, supply and erection of one thirty-ton steam wharf crane of the derricking jib type, for Halifax Dockyard. Specifications at office of Consulting Naval Engineer, Ottawa.

Sandwich, Ont.
G. Jacques & Company, Boug Building, will receive tenders until June 15th for the erection of a mausoleum for J. D. Lavin, Anahein, California. Natural stone, reinforced concrete and steel construction concrete slab roofing and floors. Approximate cost, $3,000.

Ste. Anne de le Perade, Que.
The purchase of fire apparatus to cost about $8,000 is contemplated by the village Council. An engine and quantity of hose will be required. Clerk, J. A. P. Charest.

St. Hyacinthe, Que.
Tenders will be received until June 10th by the City Clerk, A. Messier, for the supply of several thousand pounds of pig lead, 3,000 feet of 14-inch cast iron water pipe, 800 feet of 10-inch, 1,400 feet of 8-inch, and 6,000 feet of 6-inch, delivered f.o.b. G. T. R. Station, St. Hyacinthe.

St. Mary's, Ont
St Mary's Wood Specialty Company, Limited, are in the market for 200 feet of 15-inch shavings exhaust pipe.

Toronto, Ont.
Tenders will be received until June 8th by the Board of Control for the supply of four completely equipped street cars and one lathe for machine shop. Plans and specification at office of Works Department, City Hall.

Toronto Hydro-Electric Commissioners, 226 Yonge Street, will receive tenders until June 3rd, for painting street pillars and for the supply of cedar poles. Specifications with Purchasing Agent, 15 Wilton Avenue.

Westmount, Que.
Tenders on the smaller trades required in the erection of comfort stations and shelters in Westmount Park are being received by Reid, MacGregor & Reid, Drummond Building, Montreal.

Windsor, Ont.
The Water Commission of City Council will call for tenders shortly for the supply of 160 h.p. boiler equipment. Secretary to Commission, W. A. Hanrahan.

Late News Items

Acton, Ont.
Work has been started on the erection of a church for the Methodist Congregation. The masonry contract has been let to W. J. Rusk, 98 Prospect Street, Hamilton, the plastering contract to Robert Leichman, and the carpentry contract to W. B. Taylor, Barrie.

Adamsville, Que.
The contract for the substructure of the bridge being built over the Yamaska River for the Municipal Council has been let to A. Pellerin, Farnham, Que. Concrete and steel construction.

Broadview, Sask.
Tenders will be received until June 10th by J. S. Holden, Divisional Engineer, Winnipeg, for the construction of a concrete subway for the Canadian Pacific Railway. Plans and specifications at offices of Superintendent, Brandon, Man., and of the Engineer.

Crystal Beach, Ont.
Fire has destroyed business premises here, causing the following losses:—Dr. T. Snyder, Niagara Falls, N.Y., $30,000; J. Dalton & Company, $25,000; Crystal Beach Natural Gas Company, offices destroyed. A restaurant belonging to Frank Moon and the Ontario Hotel have been damaged.

East Kildonan, Man.
The roofing contract in connection with the three schools being built for the Municipality has been let to Winnipeg Steel Granary & Culvert Company, Archibald Street, St. Boniface, and the electrical contract to Scorer Bros., 502 Union Trust Building, Winnipeg.

Halifax, N.S.
The general contract for the erection of a residence on Young Avenue, for A. O. Saunderson, 14 Lucknow Street, has been awarded to Rhodes Curry Company, Windsor Street. Frame construction, concrete foundation, shingle roofing. Approximate cost, $10,000.

Harwich Township, Ont.
Tenders will be received until June 5th by Robert Tedford, R. R. No. 4, Blenheim, Ont., for veneering the school in Section No. 17 with white brick and renovating the interior. Plans and specifications with Mr. Tedford.

Montreal, Que.
Work has been started on the erection of seven residences on Hampton Street by P. Lewis, 118 Grand Boulevard. Estimated cost, $14,000.

Ottawa, Ont.
In connection with the residence being erected on Bellwood Street for the Oakland Land Company, 58 Sparks Street, the contract for masonry has been let to B. Dougherty, 16 Cayuga Street, and for carpentry to Walter Fryer, 5 Glen Ave.

Quebec, Que.
E. Carfeau, 60 Maisonneuve Avenue, has commenced the erection of a brick residence, estimated to cost $8,000. Concrete foundation, felt and gravel roofing.

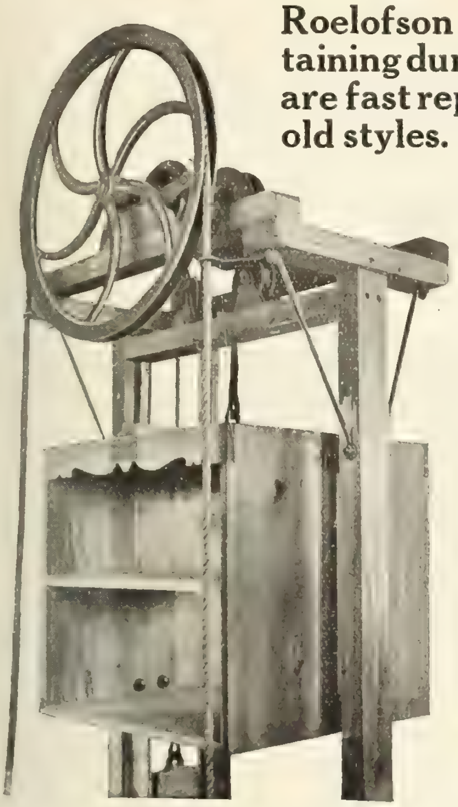
The masonry and carpentry contracts in connection with the erection of a residence on Aberdeen Street for J. E. Rouillard, 38 St. Marie Street, have been awarded to East & Masson, 62 St. Nazaire Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $8,000.

Tenders for the construction of permanent sidewalks will be received until 4 p.m., June 9th, by City Engineer W. D. Baillairge. Plans and specifications at office of Engineer.

Toronto, Ont.
J. A. Wickett Limited, Traders Bank Building, are receiving prices on about 15,000 square feet of expanded metal for the roof of the new Registry Office.

Uxbridge, Ont.
In connection with the residence being erected for Moore Bros., the contract for masonry and carpentry has been awarded to W. J. Davenport & Son, Orillia, for excavation and cement work to Winters & Company, and the heating and plumbing contract to Philips & Company, Orillia.

DUMB WAITERS



Roelofson self retaining dumb waiters are fast replacing the old styles.

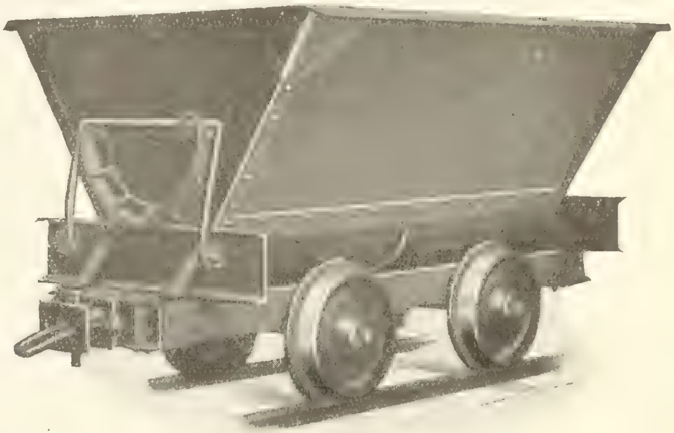
They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of cost for special machines to be used as wall hoists, freight or invalid elevators.

Roelofson
Elevator Works
Galt, Ont.

Steel Dump Cars

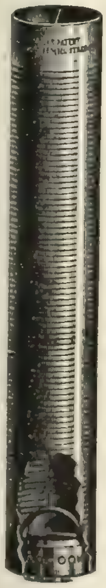
Any Size or Design
Workmanship Guaranteed
Prompt Delivery Prices Moderate



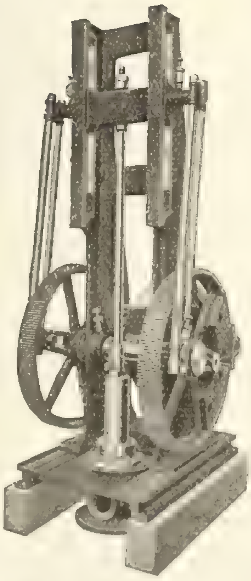
(Car Dumps Either Side)

Let us Quote on Your Requirements.

Marsh & Henthorn, Limited
Belleville, Ontario



Water Supply from Deep Wells



is obtained at a minimum cost by use of our deep well pumps.

Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer.

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Lawrenceburg, Indiana, U. S. A.

Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS**, Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

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Towers and Tanks for all purposes.

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Water supply outfits of every description.

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Made in Canada

Tarvia

Preserves Roads
Prevents Dust~

Champagneur Avenue, Outremont, P. Q.
Constructed in 1914 with "Tarvia X"

Good roads at low cost

The proper kind of roads in a community means increased property values, more accessible markets, reduced transportation expenses.

The important question now is—"Can **good** roads be built at **low cost?**

The answer is—"Yes, if Tarvia is used—and here are the facts."

For many years, outside of the heavy traffic zones in large centres, macadam roads were recognized as the most economical and satisfactory. The advent of the automobile changed this. Macadam roads, as then constructed, rapidly disintegrated under motor car traffic.

The French engineers were the first to make this discovery. They, also, were the first to find a remedy, namely, **the use of tar preparations instead of water** in building macadam roads.

Thousands of miles of macadam roadways have been treated with Tarvia and to-day a tarviated roadway with its firm, easy traction surface, free from dust and mud, is a blessing to hundreds of communities in various parts of the land.

A tarviated roadway is durable enough to be called permanent, because it is strong enough to withstand modern automobile traffic.

The first cost of tarviating a road is not greatly in excess of the cost of constructing plain macadam. The saving in maintenance expense, however, is usually greater than the cost of the Tarvia treatment.

In other words, a tarviated road is really less expensive than ordinary dusty, muddy, water-bound macadam.

Special Service Department.

This Company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by anyone interested.

If you will write to the nearest office regarding road problems and conditions in your vicinity the matter will have prompt attention.

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MONTREAL TORONTO WINNIPEG VANCOUVER

THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED

ST. JOHN, N. B. HALIFAX, N. S. SYDNEY, N. S.

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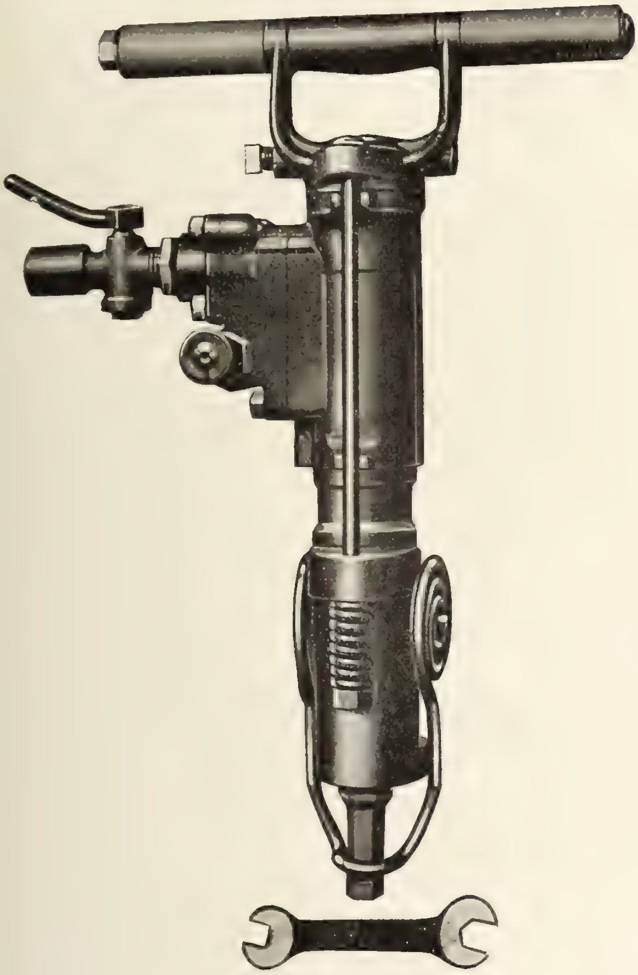

Operates by steam or air.

Drills up to 16 ft. holes.

Used for
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Trimming Walls

This tool rotates automatically and full air pressure may be directed through the hollow steel to completely clear the hole of all cuttings. This permits of drilling deep holes.

Illustration covers all the latest improvements.

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COMMERCIAL UNION BUILDING, MONTREAL, CAN. - WORKS: SHERBROOKE, QUE.

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5 Floors of This New Building, For Office and Warehouse Use.

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Special Features

- Centrally located at Adelaide and Charlotte Streets.
- Light on four sides
- Passenger and freight elevator
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- One block from four car lines
- Floor area 6,300 sq. feet, each floor.

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For
Engineers and Contractors

The following Books are Offered subject to Previous Sale:

Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton Mifflin & Company. 98 pages, illustrated. Price $1.00.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company. 100 pages. Price $1.00.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

Contract Record
347 Adelaide St. West, Toronto, Ont.

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GAUGE

Two reasons cause the user of ordinary metal lath to use a heavy gauge; the need for stiffness, and as a precaution against corrosion. Herringbone users are freed from the first reason by the ribbed design of the lath. Copper alloy the latest Herringbone improvement gives Herringbone Lath without increase in weight, an increase of 61 per cent. in resistance to corrosion. In other words, assuming a failure of the protective coating, twenty-seven gauge Herringbone Copper Alloy Lath will last longer than twenty-three gauge ordinary metal lath. And, best of all, the price has not been advanced.

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Ask for the booklet "Why Copper Alloy?"

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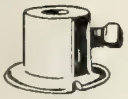
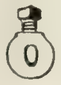


Fig. 1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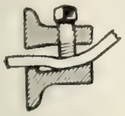
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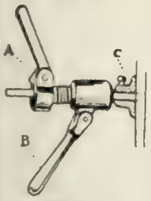


Fig. 4

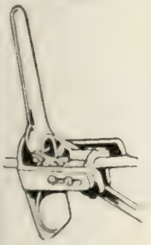
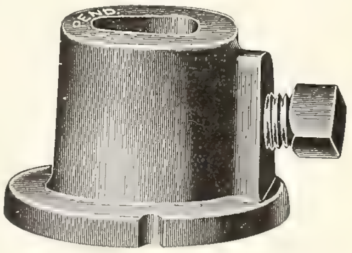


Fig. 5



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to convert any round rod into a bolt

Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section, showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screws tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

One Clamp for walls, columns and soffits This clamp is literally *universal* in application. With these low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

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I enclose 10c. Please send me a sample Universal Clamp.
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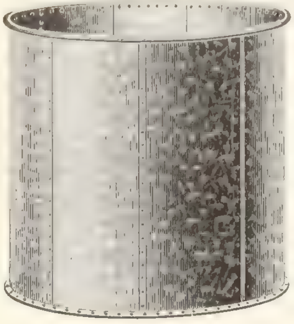

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Prices quoted promptly on heavy galvanized steel tanks for every purpose.

Wayne Measuring Systems for handling your gasoline and oils will save you money.

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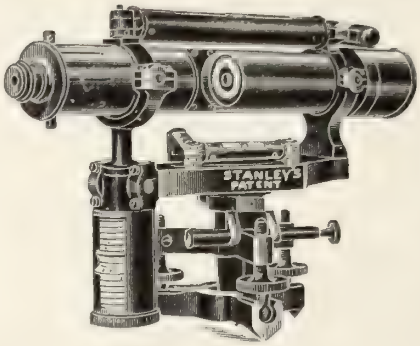

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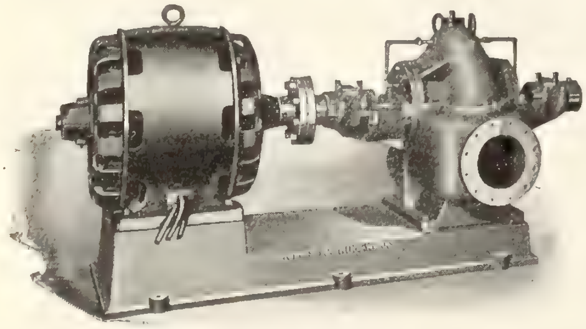

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For motor or steam turbine drive, are very popular with pump users due to their efficiency and accessibility.

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Simplicity of Design | Noiseless Running
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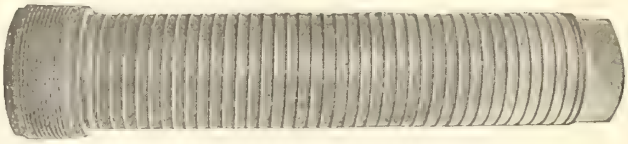

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is the most complete line of practical Road Machinery made in Canada

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Panama Giant (traction) 3300 lbs.
Panama Standard (6 horse) 2800 lbs.
Panama Boston (2 or 4 horse) 1000 lbs.
Panama Jr. Improved (2 horse) 600 lbs.

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Panama Drag Scrapers Panama Wheeled Scrapers

DRAGS
3-Way Drag No. 1 3-Way Drag No 2
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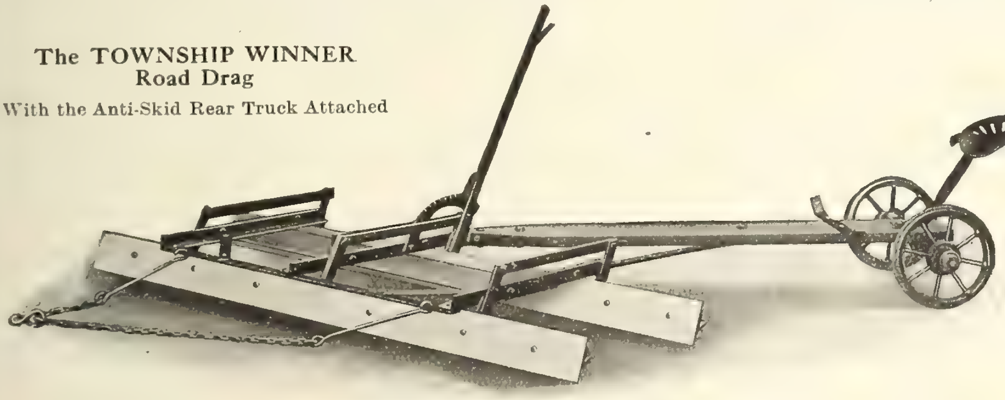
Panama No. 1 Panama No 2 Simplex

CAST IRON AND CORRUGATED CULVERTS

A FULL LINE OF CONCRETE MACHINERY



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With the Anti-Skid Rear Truck Attached

THEY ARE ALL SAYING THE SAME

"Last Spring we purchased from the Exeter Mfg. Co., Limited, one Panama Jr. Improved Grader and one Township Winner Drag with truck. The members of our Council Board were all surprised that this grader would do the heavy grading that we did with it. This is all the road machinery we have in our town and we have been able to keep our streets in excellent condition with the use of these two machines."
(Signed)
Reeve of Teeswater.

If you want Service, Get the PANAMA JR. IMPROVED. Don't Get the "Just as Good."

Ask for 1915 Catalogue No. 25

The Exeter Mfg. Co., Limited, Exeter, Ont.

J. L. Neilson, Winnipeg, Man., Western Agents T. E. Dean, Ft. William, Agent N. Ont

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Estimates furnished promptly, Capacity 18,000 Tons Annually.

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That is Clean, Tough Stone of a Quality suitable for Macadam Road and Concrete

We can supply you in any size or quantity.
Our service is unexcelled and our prices right.
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Before erecting your new building you should consider the possibilities and many advantages to be gained by the use of

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Write for catalogue, also samples, miniature or full size.

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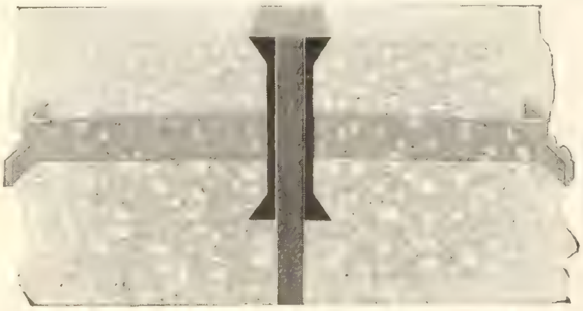
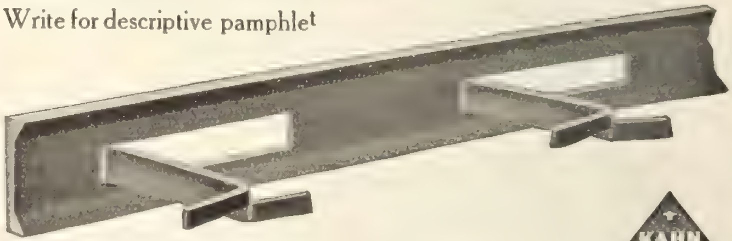


Cross-sectional view showing joint protected by Kahn Armor Plates with filler between them.

Write for descriptive pamphlet



Kahn Armor Plate.

KAHN SYSTEM

The Beveled Edge Protects the Concrete

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RAILS New and Relaying Switches, Turntables, Etc.

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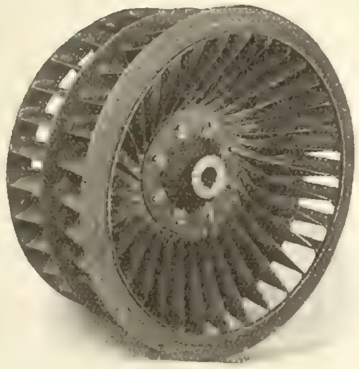

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does the work of Lumber and Sheathing Paper—does it better—and costs less. Made of heavy sheets of Asphalt-Mastic, reinforced with kiln-dried laths, Bishopric Sheathing is strong and rigid, and absolutely proof against wind and dampness, rats and vermin.

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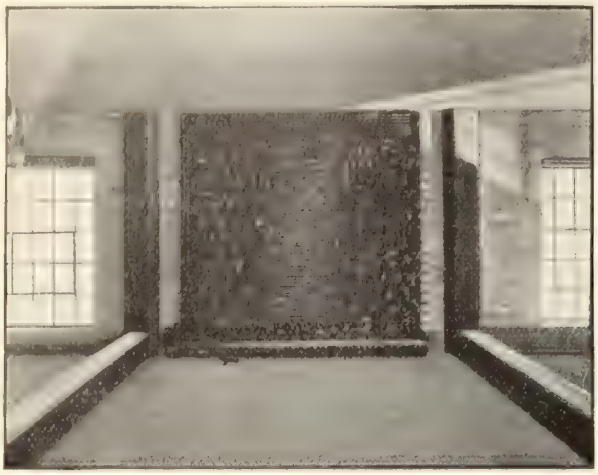

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You can buy it assured that it will satisfy the Underwriters, that it will close automatically when struck by fire and will stop the fire. Takes up but two inches on either side of opening and but one foot above. Let us submit interesting figures.

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Associated with
The Metal Shingle & Siding Co., Limited
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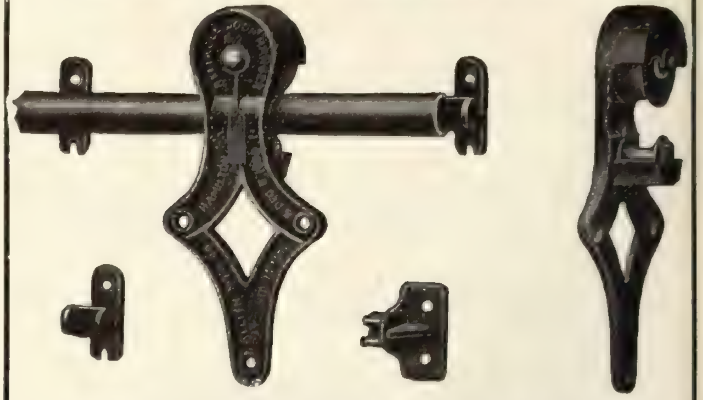

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Round Track—Easiest surface for sliding.
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For Surface Treatment of Roads the

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patent Machines are far in advance of any other Tar Spraying apparatus on the market for

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Besides being a durable, uniformly serviceable product of the best methods and the best material the world affords, they have that beautiful distinctive, unfading color that wins admiration wherever it goes.

"BRADFORD REDS"—Our smooth surfaced brick, used extensively in facing fine residences and public buildings. Made by the impervious process in standard size; by the dry-press process in both standard and Roman sizes. Ornamentals carried in stock.

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We also make fire-proofing Hollow Brick and Hollow Block.

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Here is **another** convincing demonstration of the excellent qualities of Ceresit Waterproofing Compound. This Ceresit Water Temple in the Palace of Machinery is attracting thousands of sight-seers daily.

A fountain at the pinnacle of the 16-foot high temple pours a constantly flowing stream of water over the cement dome, and this water runs along the eaves and down through the eight illuminated, glass-front pillars, reproducing in miniature **the splendor of Niagara Falls.**

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No matter how difficult your waterproofing problem—no matter how small or large; our engineers—**specialists in all phases of waterproofing**—will plan and co-operate with you without charge to secure permanent, satisfactory results.

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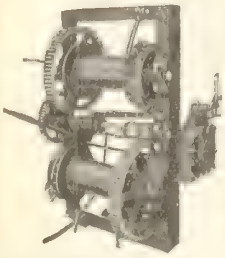

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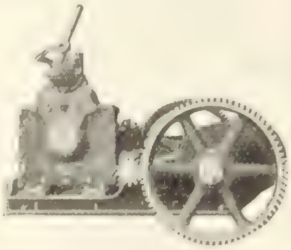

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Sand, Gravel and Crushed Stone

Lime
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Our prices are right and our service good.

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During the past few months we have supplied ornamental lighting standards for the following places:—

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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

William Hamilton Company
Peterborough, Ontario

The contract for the new Half Million Dollar Civic Library at Montreal has been awarded in

"Queenston Blue" Limestone

Specify and get the best Canadian Stone.

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Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of terrific usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

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Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

"Metallic" Building Materials

Use British Goods—Support the Empire!

Every foreigner who sells you goods that you could buy in the Empire is taking just that much money away to build up foreign industries and keep foreign workmen employed.

Keep the money at home where it will circulate back to you. Especially when you can get equal or better values at home. The "Metallic" line of building materials is British-made through and through.

The "Metallic" line includes "Empire" Corrugated Iron; "Eastlake" Steel Shingles; Steel Siding, Ceiling and Wall Plates; "Hayes" Patent Lath; Skylights; Ventilators; Galvanized or Copper Cornices; Fire-proof Doors and Windows; Well Curbing; Culverts; Conductor Pipe and Eave-Troughs.

Write today for illustrated catalogues and price lists.

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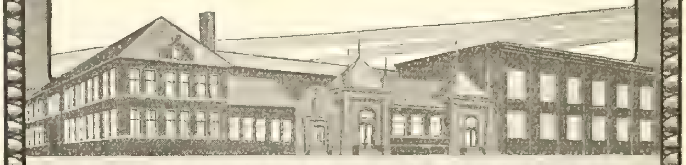
Manufacturers—Toronto & Winnipeg



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TRIDENT Frost-Proof Water Meters

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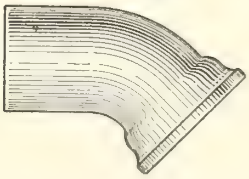

Ask us to quote on your next order—any size, 3" to 60" diameter, bell and spigot or flange—also special fittings and castings of all kinds.

For fifty-eight years we have manufactured the best quality of cast iron pipe.

Information and prices on request.

Warren Foundry and Machine Co.

11 Broadway - NEW YORK

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $21; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22; No. 2 Hemlock, dimension and 1 in., $19 to $21.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $42; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $27; No. 1 pine decking D 2 S, $28; spruce decking, $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casin, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $3.40 to $4.50; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.40; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $4.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto proces (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 81c. per gal of 9 lbs.

Raw linseed oil—in bbls., 78c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bbls., 73c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.50; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. yd. net cash. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $5.05 per 100 lbs.; Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15½c basis per pound; British manilla, 13c basis; African hemp, 13c; sisal rope, 10½c basis; lath yarn, 9¾c. Boiled linseed oil—in barrels, 82½c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles. beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 72)

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 30 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $25; fire clay, $12 per ton.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $5.35 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

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Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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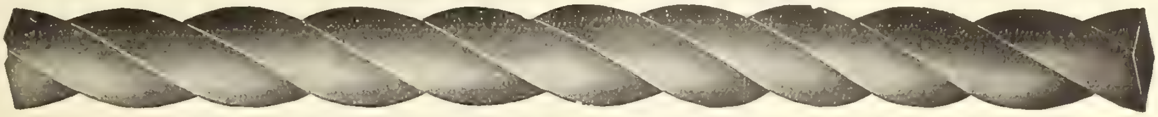

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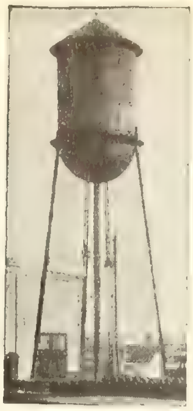

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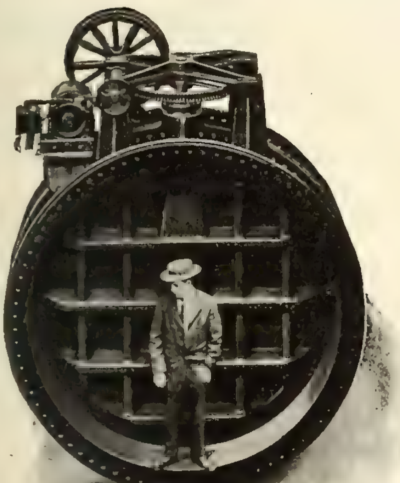

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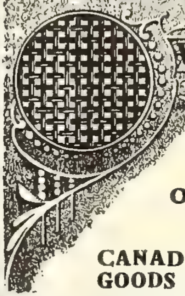

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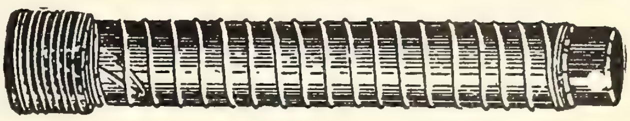

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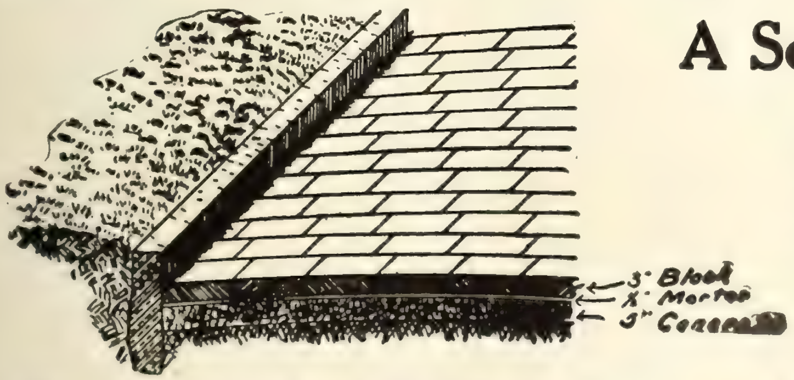

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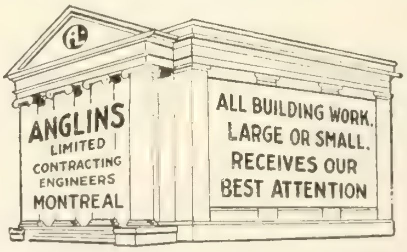
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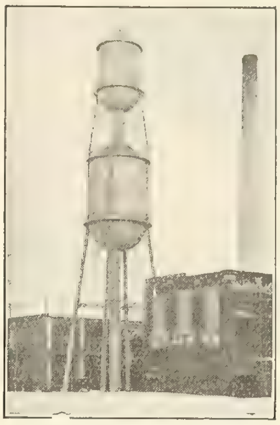

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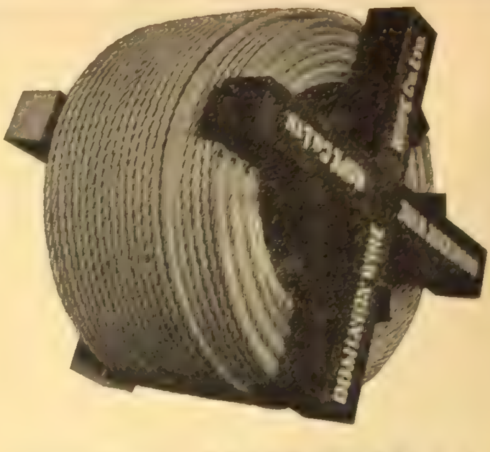

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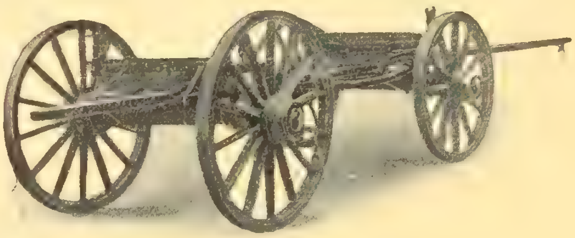

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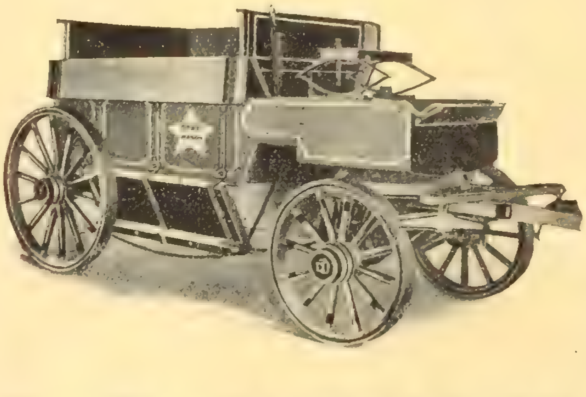

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(Let The Buyer Beware!)

Was the old way of trading.

"ADIUVETUR EMPTOR"

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Is our "SERVICE" way of trading.

Our line-up is complete, our quality is unexcelled, and our prices are right. Let us show you what we can do.

It is our desire to serve you.

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

Canadian Consolidated
Rubber Company, Limited
Montreal, P. Q.

28 "Service" Branches
Throughout Canada

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
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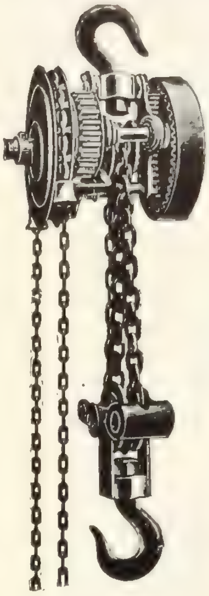

Fig. 1
Hoist showing lower block in position for regular or slow speed.

Aikenhead's

Spiedel Chain Hoist

One man with an eight-ton hoist can lift 16,000 lbs.

These hoists are best from the standpoint of efficiency, speed and price.

When used to only half capacity, speed is doubled by locking one of the lift chains.

Made in various sizes, with safe working capacity of 1,000 to 40,000 lbs.

Store open Saturdays till 5 p.m. other days till 6 p.m.

Aikenhead Hardware Limited

17 Temperance St., TORONTO, Can.

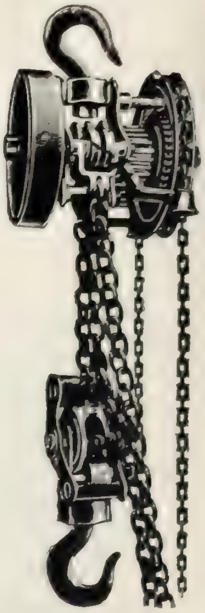

Fig. 2
Hoist showing lower block in position for fast speed.

Spruce Dimension

in any sizes up to 12-in. and in any lengths up to 30-ft.

Also Random lengths in plank and timber.

Spruce treated by the Kyanizing process to preserve it from decay a specialty.

Send for Illustrated Booklet and Prices

BERLIN MILLS COMPANY

Portland, Maine

(Founded 1852)

No. 232

"R. I. W."

REMEMBER IT'S WATERPROOF

DAMP RESISTING PAINT

Bond Plaster to Brick or Terra Cotta Wall **Saves Cost of Furring and Lathing**
Damp-proofs Foundation Walls **Insulates and Checks Dampness**

A decided advantage in the use of No. 232 "R.I.W." is the elimination of the air space that occurs when wooden furring is used, which, in the event of fire, is a passage for flames. Wooden furring also provides a lurking place for vermin, but when No. 232 "R. I. W." is used and plaster applied directly over it the migration of vermin is effectually checked.

Write for a copy of Red Book, describing this and other "R. I. W." Compounds.

Somewhere in the "R. I. W." Line there is a Paint for every Technical Purpose.

MANUFACTURED IN CANADA BY

"R. I. W." DAMP-RESISTING PAINT CO. **202 Mail Bldg., TORONTO**
Factory, Oakville, Ont.

DISTRIBUTORS:

Black Building Supply Company, Limited, Toronto
Western Paint Company, Winnipeg
Dartnell, Limited, Montreal
Canadian Equipment & Supply Company, Limited, Calgary and Edmonton

It's the All-Steel Machine With the Cut-Steel Gears!

Cut-steel gears—every high speed gear cut from solid steel blanks—are only one of the features of this many-featured machine. If you have ever been up against the kind of a job that strips gear teeth and holds up the work, you will recognize the value of the 'P & H."

THE MACHINE "BUILT BY THE CONTRACTOR"

This is the machine built to meet and overcome the obstacles that have been the contractors' problems for years. This is the machine with cast-steel buckets with double-ended tool steel teeth—steel chains—manganese steel bushings—and a structural steel boom of the box girder type which insures maximum rigidity and strength. Get a "P & H" and get the machine with the sure-clean buckets, and the conveyor that will dump on either side as desired!

Git a "P&H" —says Cassidy

Let us send you a copy of Bulletin 240 X
—It will tell you all about the "P & H" All Steel Excavator.

Pawling & Harnischfeger Co., Milwaukee, Wis.
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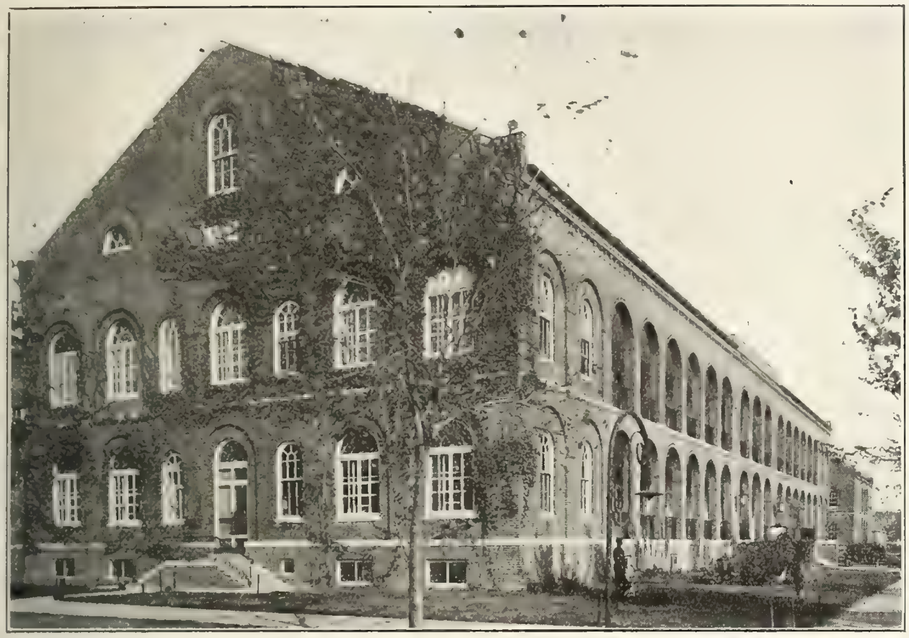
(Continued on page 12)

Simplex Concrete Piles

Have a Good Record



Barracks Building No.1, Washington, D.C., was built ten years ago across an old inlet of James Creek, filled with mud. The two ends of the building rest on firm ground and Simplex Concrete Piles carry the middle by going through forty feet of soft mud to hard pan. **This difficult natural condition tries out a Pile, but Simplex stood the test.**

Back in 1903 the first simplex concrete piles were put in at Washington, D. C. The United States Government wanted to erect some thirty brick buildings on very bad ground, and the Simplex Concrete Pile was created to save the day. Since then it has solved hundreds of difficult foundation problems all over the world.

For Durability

A Simplex Concrete Pile is equal to natural rock because it forms a perfect monolith. Its cylindrical shape gives the column of concrete the maximum strength throughout its entire length and the maximum bearing service permits it to be driven **any** depth. The withdrawal of the driving tube forces the plastic concrete to be cemented into the compressed earth itself. Piling made on this principle cannot fail to give

A SURE FOUNDATION. Our 96-page book ought to be in your file. Write for it. It shows why

SIMPLEX IS

the most practical system of placing in the ground straight cylindrical Concrete Piles to suit any condition of soil and loading. Simplex Piles can be easily reinforced to any desired extent; have the greatest sectional area; friction surface; and end bearing in hard-pan.

Made in three styles—the Standard Simplex, the Premolded Inserted Simplex, the "Composite" (in combination with Wooden Footing Piles).

Simplex Concrete Piling Company of Philadelphia

Canadian Representatives

Simplex Construction Company, Limited

Coristine Building, MONTREAL

"Simplex Piles Drive to Firm Footing"

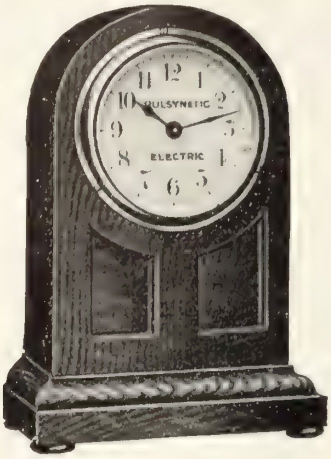


Fig. C 21. Mantel Clock

ARTISTIC MERIT

as well as accuracy in Time-keeping is embodied in all Pulsynetic Electric Clocks. No matter whether they are to be fixed in the Residence, Office, Factory, Warehouse, or Tower, we have the correct design at the right price.

One master transmitter controls any number of dials, irrespective of size or position and never wants winding.

Architects, Engineers and all interested in Correct Time should send at once for our Book Five, or full particulars and prices may be obtained from:—

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442 Sherbourne St.
TORONTO

Gent & Co., Ltd.
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Cables, Lodestone

KERR

Gate Valves
and
Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

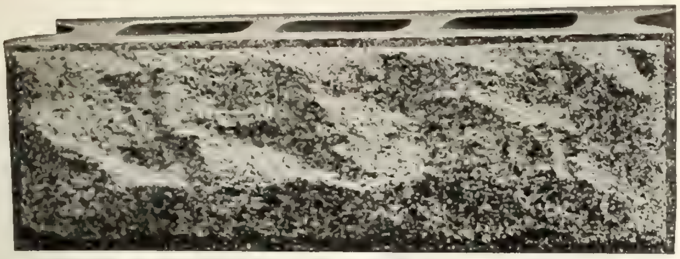
Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO



8 x 8 x 24 inch Granite Rock Face Block

Molds for Casting

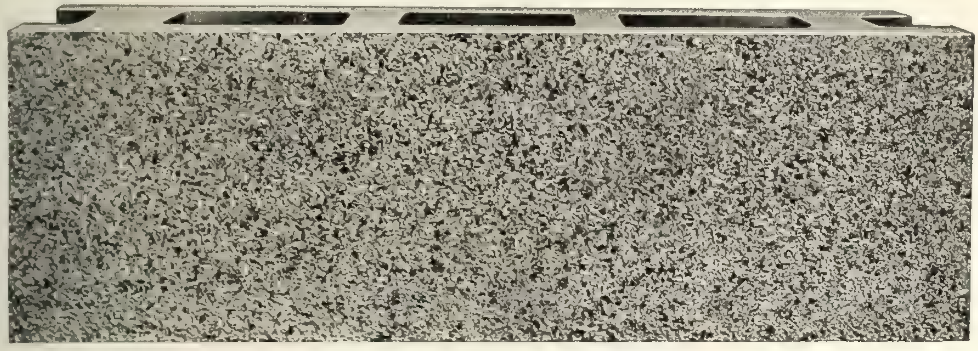
Waterproof Hollow Cement Building Blocks

With Granite Faces

THEY COST LESS — THEY SELL FOR MORE

YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited **(Zagelmeyer System)**

298 Howard Avenue, WINDSOR, ONTARIO

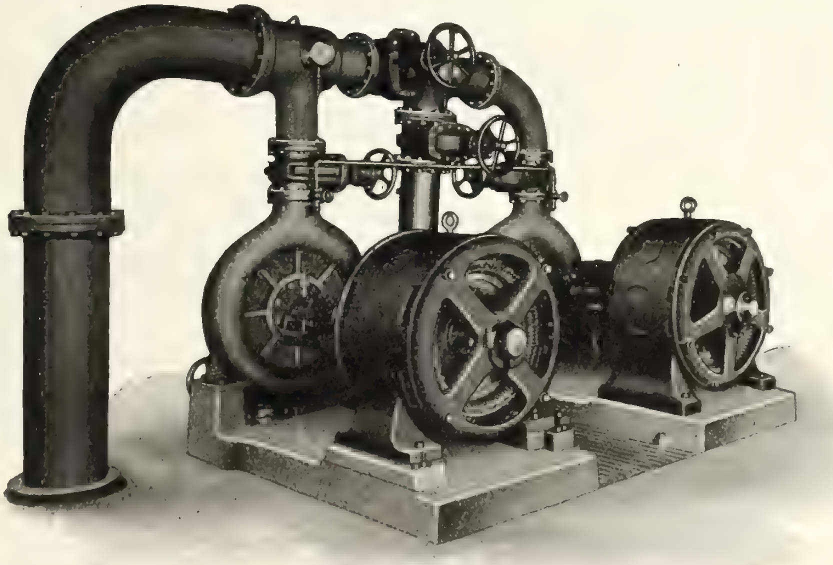
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

from

Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.

HOW MANY WAGONS

show up on your job every morning?

Are there long expensive layoffs for repairs? If so—better get Watsons.

Repairs are mighty few and easily made by duplicate parts. You can depend on Watsons.

John Deere Plow Co. of Welland, Limited
77-79 Jarvis Street, TORONTO

HERE IS ECONOMY
NOT EXTRAVAGANCE

This contractor is getting exactly twice as much profit this year as he did last year on similar work. Last year he excavated by hand at an average cost of about 16c. per yard. This year his costs are but 8c. per yard. And this year he bids on jobs he couldn't touch last year. Can you afford **not** to have a Browning?

THE BROWNING CO.
CLEVELAND, O.
Sales Offices :
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JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

EVERY product sold under this emblem is backed by J-M Responsibility—a new order of Service pledged by a nation-wide organization that has had over half a century of experience in solving **your** problem.

J-M Products are made not merely to sell but to give satisfaction in use. Hundreds of J-M Service Representatives everywhere give this assurance. That's J-M Responsibility.

J-M Asbestos Roofing and Siding
J-M Underground Conduits
J-M Mastic Flooring
J-M Waterproofing Materials
J-M Cold Water Paint
J-M Transite Asbestos Wood
J-M Lighting Systems
J-M Insulating Felts and Papers
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J-M Cold Storag Insulation
J-M Pipe Coverings,
J-M Acoustical Correction
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The Canadian
H. W. Johns-Manville Co., Ltd.
Toronto Montreal Winnipeg Vancouve
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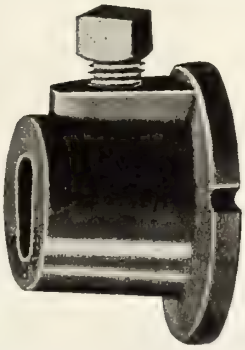
Universal Form Clamp



Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

Write today for Circulars and Prices

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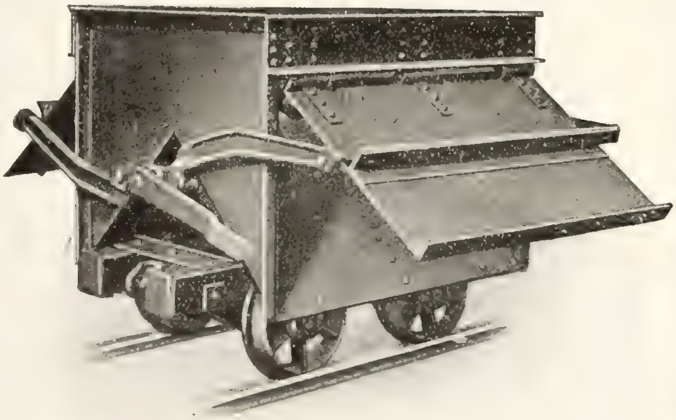
DUMP CARS

Made to dump both sides, both ends, or all round.
All sizes and designs. Steel Construction.

Mine Cars Industrial Cars



The side dump car, U or V shaped, or constructed as shown above, offers many advantages over other styles for brickyards, contracting work, sand pits, mines, and industrial purposes. Made with chilled semi-steel wheels, cold rolled steel axles, high carbon roller bearings in dust proof boxes.

BRICK MAKING MACHINERY of all kinds. Special attention paid to AUTOMATIC CUTTERS and the equipment of brickyards with ARTIFICIAL DRYERS.

B. E. BECHTEL, Waterloo, Ont.
(Successor to Bechtels Limited)

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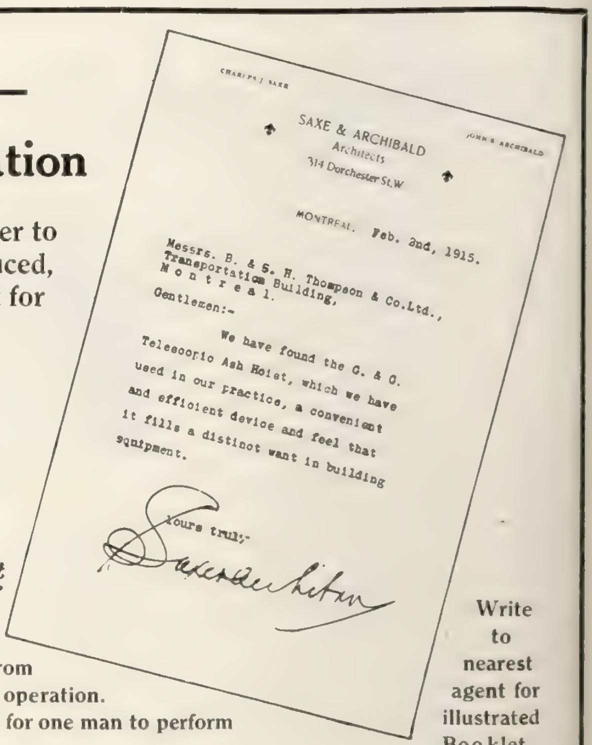
(Continued on Page 14)

SAUVEGARDE BUILDING, MONTREAL

In Montreal alone, a number of the most prominent buildings are equipped with the G & G Telescopic Hoist

Another Letter—
And Another Installation

Messrs. Saxe & Archibald whose letter to our Montreal agents is here reproduced, specified the G & G Telescopic Hoist for the La Sauvegarde Building.



CHARLES J. SAXE
SAXE & ARCHIBALD
Architects
314 Dorchester St. W.
JOHN S. ARCHIBALD

MONTREAL, Feb. 2nd, 1915.

Messrs. B. & S. H. Thompson & Co. Ltd.,
Transportation Building,
M o n t r e a l.

Gentlemen:-

We have found the G. & G. Telescopic Ash Hoist, which we have used in our practice, a convenient and efficient device and feel that it fills a distinct want in building equipment.

Yours truly,

Saxe & Archibald

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with compound gear and brake attachment

Raises a maximum load of 500 lbs. at a speed of 30 feet per minute, operated from sidewalk. Clean, safe and **noiseless** in operation.
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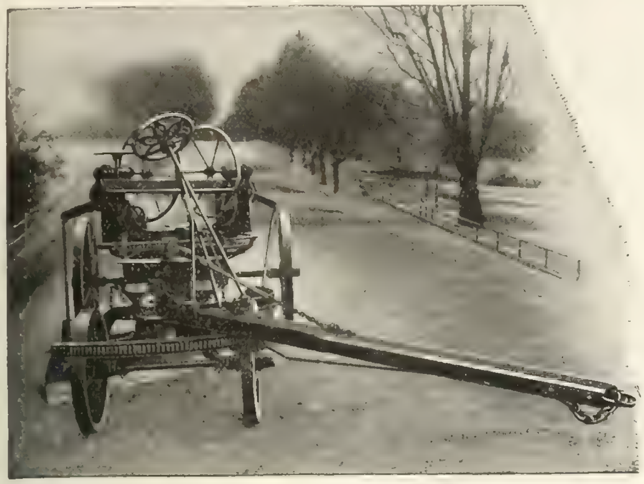

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Length of blade .. 7½ feet
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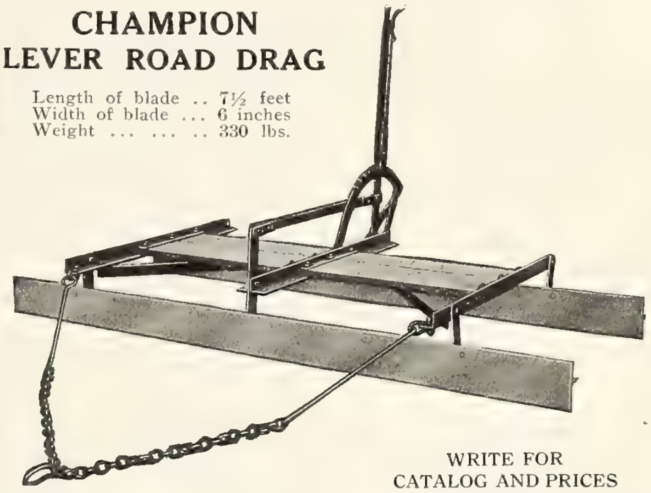

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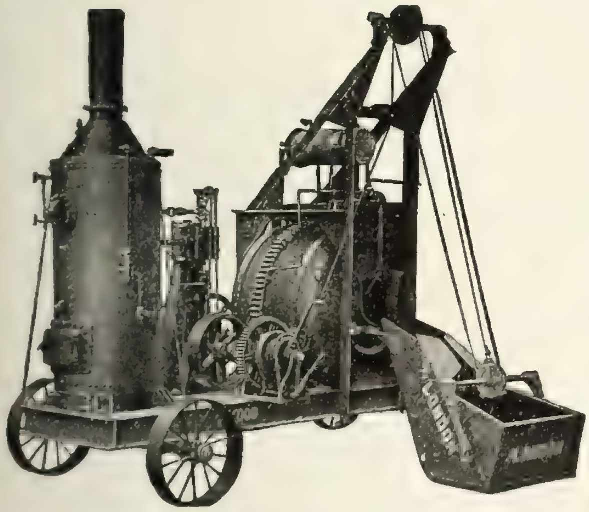

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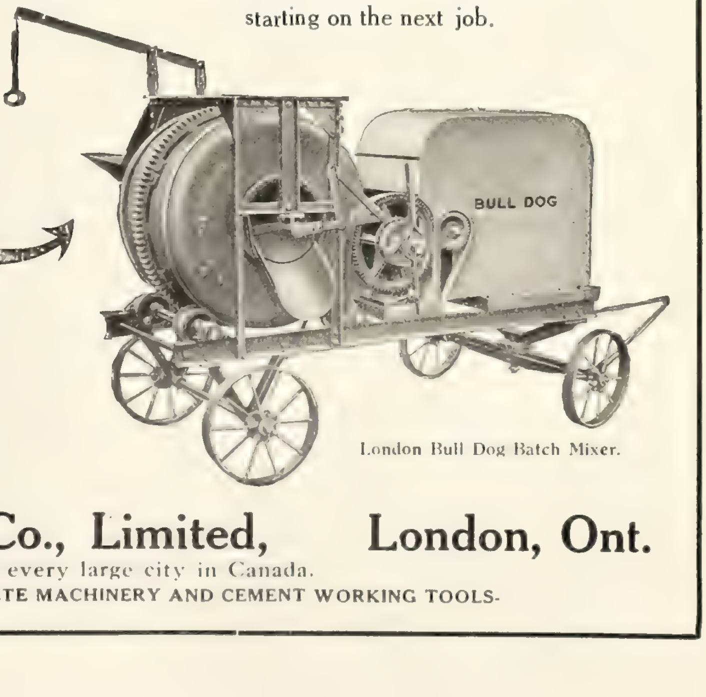

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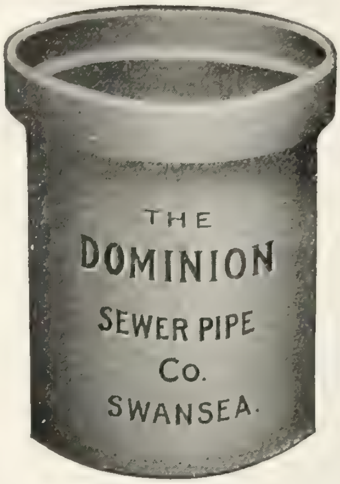

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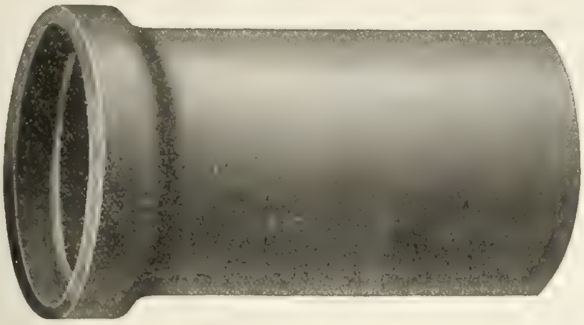

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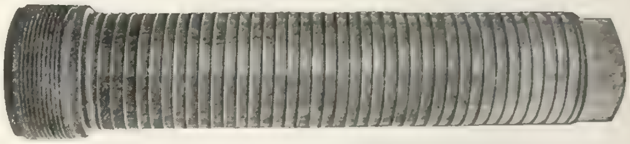

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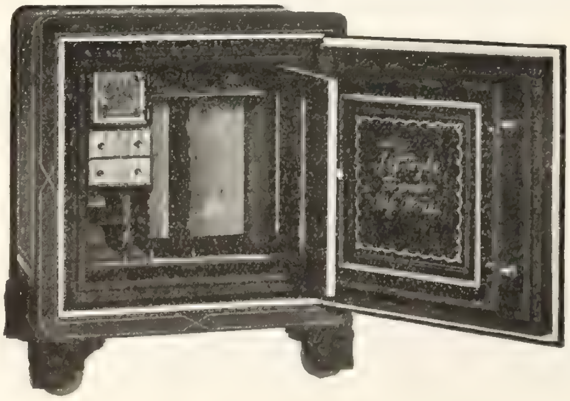

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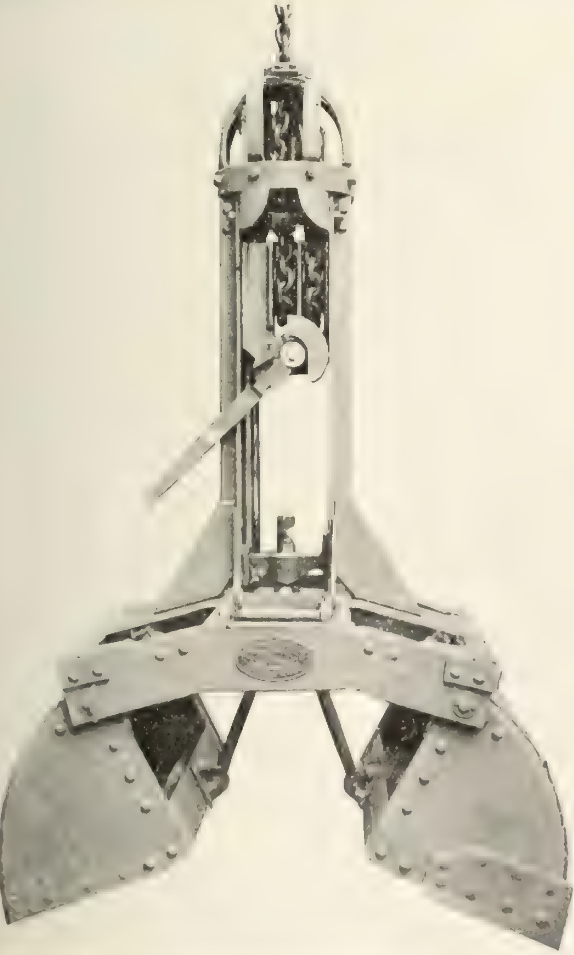

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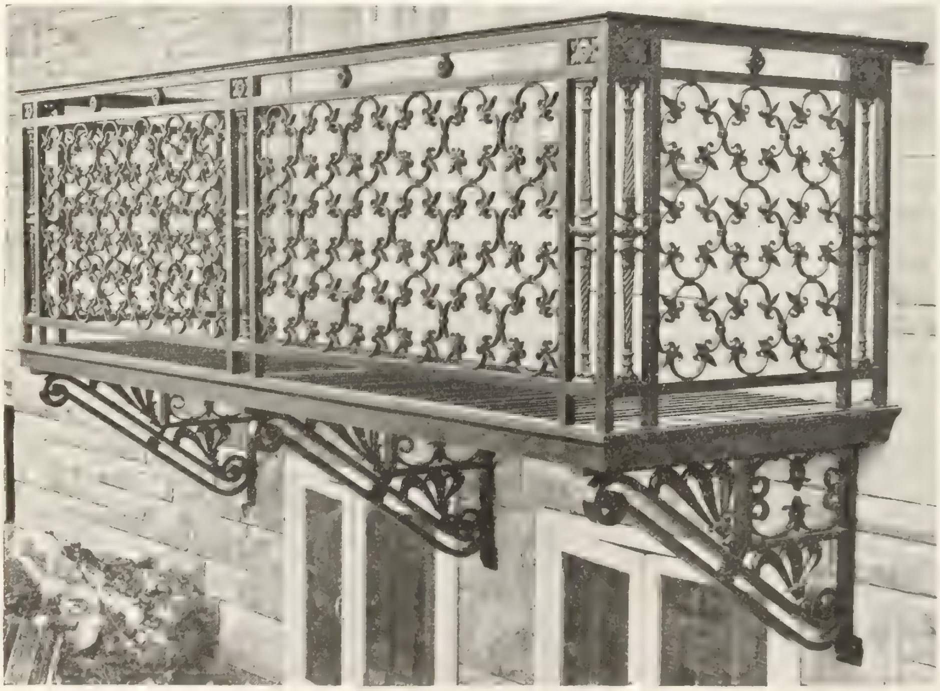

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The Activities and Inactivities of the City of Montreal

ONE of the immediate results of the outbreak of war was the practical cessation of activities in relation to municipal expenditure. In some instances schemes were postponed, in others works were stopped, and there was a disinclination to consider any outlay except that which was imperative. Since that date there has been a decided change in the direction of a more liberal expenditure. A comparison of the notices in the Tenders and For Sale Department of The Contract Record indicates that municipalities are gradually increasing their appropriations.

The war has served a useful purpose in that it has forced municipalities to take stock and to examine more closely into their expenditures on improvements. In the boom period there was a tendency to make lavish outlays without a due consideration of the financial obligations which were being incurred, and to run up heavy bills without considering the cost. In the West the rivalry between cities has not been without its influence. We have been going too fast, and now that Great Britain is perforce obliged to discontinue lending us money on such a liberal scale a halt has been called. To a certain extent the United States has supplied the deficiency, but it may be taken for granted that the borrowing by municipalities will be restricted in view of the European situation.

Undoubtedly by far the greater proportion of the borrowed capital has been spent on necessary and reproductive schemes, but one cannot ignore the fact that in too many instances debts have been incurred too willingly, and that there has been a large amount of waste. The city of Montreal is an example of a city with an ever-increasing debt combined with methods of expenditure which are open to serious criticism. Although there has been an improvement since the days of the Cannon inquiry, there is still a large leaven of the aldermanic system which made for outrageous expenditures in the different wards. The appointment of Controllers curtailed the pernicious system of patronage under which the aldermen were constantly manoeuvring for heavy outlays in their particular districts; but the hands of the Controllers are still partially tied owing to the opposition of many aldermen, who regard with disfavor the powers of the Controllers, and who are anxious to return to the good old days when they exercised patronage. Efforts have been made to curtail the jurisdiction of the Controllers, but fortunately Premier Gouin was wide awake enough to veto the proposed charter amendments and to counteract the lobbying of the reactionary aldermen.

The enormous increase in the expenditure of Montreal is shown in a return just compiled by the City Comptroller. In five years the debt has more than doubled; in December, 1909, the consolidated debt was $36,029,995, while in December, 1914, it was $78,304,020—an increase of $42,274,025. It is estimated that the debt per head is $150 against $66 five years ago, part of this increase being due to the annexation of outlying districts. While much of the borrowed money has been well spent, any one acquainted with the later municipal history of the city, and with the scandals which have surrounded certain public works, can give a pretty shrewd guess at the enormous waste—to put it mildly—that has accompanied this heavy increase in the public debt. The city has added to its pay-roll of employees at an alarming rate: in 1908, 166,396 people were employed, the cost being $2,641,-

011; in 1914 the figures were 556,222 and $8,635,700. The situation has become so serious that Controller Hebert, who is responsible for the finances, predicts a deficit, when the interest charges are paid. Here is an instance of a city going at too great a pace, and of adding millions upon millions without looking to the future. The depression has forced the city to limit its outlays on improvements, and it has had to omit from the budget many works which were at first proposed. The aldermanic interference with the Controllers' reports has been so continuous that, as a way out of the friction which naturally follows, it has been proposed to abolish the Council, substituting for it a body of well-paid Controllers, experts in various phases of local government and engineering, who will each be responsible for the management of a particular department. The present plan of divided control has not been a success, and as the old aldermanic regime is an impossible one, from the point of efficiency and of spending money on improvements to the best advantage, the appointment of several business men to run the city on business lines is at least worth a trial. Two or three American cities have decided to adopt the "pay-as-you-go" system of administration—to pay for improvements out of revenue instead of borrowing. Although this has decided disadvantages, at any rate it would prevent the accumulation of huge debts, the interest on which is a serious burden to the citizens.

The Economy of Testing

THERE are certain bed-rock truths which have been established by experience and the test of time. It would be very foolish to proceed in a contrary direction unless one courted disaster, or at least a partial failure. It is not always a question of the use of the right materials, but of their quantity and quality. A ton of clean ballast and a hundredweight of cement will not make a good floor any more than dirty sand and poor lime will make a good ceiling. It is evident, therefore, that there must be great economy in following the results gained by testing. By testing one gets to know, and the accumulation of this knowledge allows of the carrying out of work on right and safe lines. It is known, for instance, that the design of a certain pipe for a certain purpose under certain conditions should be of such a material and of such a strength, because past experience has taught that it should be so; but a further test is required. The pipe may hold up to all the proper dimensions, and may look very good, but it is necessary that it should also be tested in its working position. In a recent case iron water pipes were cast and tested at a foundry under the supervision of an inspector. The pipes were struck with a hammer in all their parts while under pressure, and test bars of the metal actually used were also carefully proved. Subsequently the pipes when laid were tested in the trenches by hydrostatic pressure to 50 lbs. to a square inch above the working pressure, the result being that 460 10-in., 89 6-in., 97 4-in., and 10 2-in. pipes, weighing about 141 tons, or over 8 per cent. of the total weight delivered, were rejected. Can any one but a town surveyor realize what it would have meant to have lived in that town had the final test not been carried out before the system was completed? Rule of thumb, or "having a shot at it," may be an easy way of taking up responsibility, but it is not usually economical. As one cannot take the cover off the earth and see the conditions below, it behoves us to use the boring tool or the sunk shaft to ascertain as much as we can. It has been said that 70 to 80 per cent. of the failures of works subject to earth pressure are those constructed in clay, and most of the failures of reservoir dams have occurred through the movement of the clay foundations. We may be sure that had such clay been known to be treacherous it would not have been relied upon. Settlements and other mishaps frequently occur from buildings being erected on unknown foundations, whereas such happenings would be prevented if adequate investigation and trial were made of the ground previously. On the other hand, the extra careful rule-of-thumb man may cause great waste of materials by ignorantly overdoing the necessary margin. Knowledge leads, of course, to a great saving in expenditure, allowing as it does a sufficiently large—but not too large—margin of safety.

A definition of dirt is "matter in the wrong place;" in many instances this would be a good definition of waste, too—a waste caused by the use of unsuitable materials. Failures in road surfacing, failures in roof covers, failures in wall painting, and the rest, are evidences of the lack of testing or experience. The good soldier is the man of tested qualities, upon whom his General may rely. It is economical to employ such a man—he is worth many untrained, untested, raw recruits. It is the same in the engineering sphere—we shall be best served by using materials that have stood the test—bricks from the good brickyard, granite from the good quarry, pipes from the good foundry. There is no economy in using bricks which are affected by frost, or granite that pulverizes under the steam roller, or pipes that burst under working pressure, because they may be cheap to buy. How are we to be sure of the quality of our materials? Only by testing, carried out either by ourselves or by others upon whom we may rely. How often the engineer and surveyor sighs for an expert opinion on some material which he would like to use but which he has had no opportunity of testing himself. He dare not risk it on the recommendation of the interested purveyor, although it may possess the merits claimed for it in the lurid leaflet. Where a material or system has been tested thoroughly by a careful, disinterested investigator it would be most valuable if the result could be scheduled in some permanent way for the use of official engineers—in which case the length of the visits of various commercial travellers would be much curtailed. Then a reference to the suggested schedule concerning some material or process—for which every excellence was claimed—would show the opinion of the expert investigator, and his verdict, "unsatisfactory," "inferior," "not reliable," "good," "excellent," as the case might be, would lead to a great saving in time and trouble, to say nothing of future heartburning. It may be contended that the technical press at the present time does print a good deal of information on these lines. That is so; but it is not in the province of that press to do what is needed, especially in the matter of protected articles. Life is short, and it seems a pity for knowledge acquired through laborious hours to be lost, and for man after man to tumble into mistakes which could be avoided by a reference to a book of duly recorded investigations or observations. Just as the tradesman finds it economical to test the suspiciously new-looking florin that may be tendered to him, so the engineer would find it economical to test the new materials—as well as the old—that may be offered for municipal consumption.—The Surveyor, London, Eng.

Assessing the Cost of Water Main Extensions by Municipally Owned Water-Works[*]

By D. A. Reed[†]

FEW subjects are of more general interest to the officials of water departments than the methods employed by various municipalities in the assessing of the costs of water main extensions. The procedure at Duluth, Minn., is here described. The method is simple and rational, and is easily applied.

An improvement of any kind which is largely local in nature—that is, one which from the nature of its construction is largely an accommodation to the abutting property—is found in lateral sewers and water mains of minimum capacities supplying or serving local properties only, which do not provide capacities in excess of local requirements, and which are not indispensable for serving more distant territory.

A city-owned utility usually has the power to assess certain benefits, whether the party interested chooses to be a consumer or not. Applying this fact to sewers and water mains the proper method would be to assess the cost of construction, or, in other words, the capital investment, against the property that it is possible to serve. The costs of operation, however, should be levied against the parties purchasing the output or using the service.

In the case of a municipal water supply these matters seem to be much easier of solution, and it seems quite practicable to assess the costs of construction directly upon the property susceptible of being served, and to assess the operating costs directly upon the customers or patrons of the utility, in proportion to the quantity of water consumed. This condition, it must be observed, is not met entirely by a rate charged upon a demand and output basis such as is in effect in New Orleans, for the reason that the demand charge does not extend to vacant property.

This fact will appeal to those who believe that vacant property should not escape taxation for any improvement that directly enhances its value. It would also seem to be a fair check or restraint upon interests that invest in idle property with a view to gain which results largely from the activities of others.

It is assumed that a municipal water plant should be self-sustaining in every sense of the word. It should neither give nor receive any benefit or consideration of any kind from the taxpayer, the city, or the individual.

A water main in which the size is in excess of the minimum may be classified as serving two purposes—the service to the property directly abutting, and the service to properties located more distantly from the source of supply. In the first instance, for the purpose of this discussion, a 6-in. service may be considered as sufficient, and all sizes in excess of 6 ins. for the additional service to those more distant. Assessments against abutting properties for the 6-in. main are easily applied. For costs of main in excess of this size the only practicable way appears to consider the additional cost as a part of the general distribution system, the expense of which has to be absorbed by the utility and included in the consumer's rates chargeable as operating costs. The direct assessment to the abutting property for the 6-in. main (this size being used as a matter of convenience) may be assessed against the abutting property by means of either of two methods: first, in the total, on the completion of the work, which is paid by one assessment; second, the principal being furnished from the funds of the utility, a percentage may be assessed annually against the property to cover interest and sinking fund upon the investment. After a term of years the percentage assessment will have returned enough money to the utility to cover the principal as well as the interest upon the investment. Ordinarily the vacant property thus assessed should continue to pay the assessment for the full term of years necessary to wipe out the original costs. Improved property, using water and paying for it upon meter rates, would be entitled to some credit or rebate on account of these rates, especially if the rates are based upon capital investment expense as well as upon operating costs upon the entire plant. Assuming for the purpose of illustration that one-half of the water rates are to cover interest and sinking fund expense, and that the balance is to cover operating costs, including depreciation, it will be found necessary to credit one-half of the customer's water rates against his assessment. This credit will ordinarily retire the annual percentage assessment upon improved property, unless the cost of constructing the extension was large and the consumer's consumption was low. If his consumption is considerably more than necessary to wipe out his individual assessment, the surplus, of course, should be applied pro rata to lessen the tax upon the vacant property. It is quite possible for the consumption on an extension to increase to such an extent that the overplus of credits will be sufficient to retire all the assessment against the vacant property upon that particular extension—in which case, having reached that point, all assessments should be discontinued, as the customers are carrying the entire expense of the extension, including capital investment as well as operating costs. This may be accomplished even at the end of one year or two years, or possibly ten or fifteen years, depending upon the rate of the percentage assessment against the property, the interest and sinking fund factor in the rates charged for the water, and the amount of the consumption upon the extension.

It is also quite possible that an extension may be made where there is no consumption for the first year. In this case all the property pays the percentage assessment with no credits, and the utility receives the exact amount necessary to pay interest and sinking fund charges.

The method employed at Duluth, Minn., in which a gas utility is also operated in connection with the water system, the pipes being laid in the same trench, has been to assess annually against the abutting property 8 per cent. of the total cost of each extension as represented by a 4-in. gas and a 6-in. water main, it having been established that sizes in excess of these dimensions would be more or less of a general benefit to all customers and property and permit of the strengthening of the system to benefit other customers outside of those served by that particular extension. The proportion of charges against the abutting property has been based upon 5 per cent. for interest and 3 per cent. for sinking fund, assesed annually for a period of fifteen years. A 3 per cent. contribution to a 4 per cent. sinking fund, however, will not retire the principal in less than 22 years, but for various reasons it has been considered advisable to limit the duration of annual assessments to a fifteen-year term. A special discount of 25 per cent. is allowed to those paying the total amount in one payment. These assessments are made according to the frontage of the lot, without reference to its depth. However, the frontage of the lot is not considered necessarily as being the side abutting on the street upon which the extension is made; it may lie parallel to the mains and front on another street. It is assessed the same as other lots of the same frontage dimension. Subsequently, if mains are laid in front of the short side, no assessment is made therefor on this particular lot, which of course can receive no benefit from a second extension. Against this assessment is credited one-half of the water and one-third of the gas rates paid by the occupant of the premises, it being estimated that these proportions are necessary factors in a rate that will yield the proper amount of revenues for maintaining and operating the plant.

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[*] Abstracted by Engineering and Contracting from a paper before the Annual Convention of the American Waterworks Association.

[†] Manager, Water and Light Department, Duluth, Minn.

The principles and results involved in the methods as outlined above seem to be as follows:

1. All charges, whether of installation or of operation against property or a customer, are based upon actual cost.

2. Costs of distributing systems are ordinarily borne by abutting property except when the consumption is sufficiently large to assume the whole or part of this expense, when the charge is gradually transferred to the customer.

3. The customer bears operating costs and such installation charges as cover reservoirs, pumping machinery, stations, intakes, and the larger distributing mains.

4. As the municipal plant increases in size and in the amount of its revenues, its percentage of indebtedness will gradually decrease, and the proportion of interest and sinking fund in the rates charged for water will decrease until eventually, when no indebtedness exists, this factor will become zero and there will be no credits against the assessments. They will have to be met in full cash payments, or the consumer may discount the entire amount of his individual assessment by paying cash, taking advantage of the 25 per cent. discount.

5. The percentage plan enables the small property owner who is a consumer to obtain extensions on very easy terms, with practically no additional expense over and above the regular water rates.

6. It seems to be a practicable way for real estate owners to secure extensions of gas and water service in newly platted additions without throwing any of the burden upon the utility or its customers.

7. It furnishes a profitable investment at 8 per cent. net for the sinking fund of the department until the time arrives when it will be needed to retire bonds, at which time, if the money or any portion of it cannot be withdrawn, refunding bonds or new bonds in whole or in part may be issued. Eventually, if the rates for service have been established correctly, the time will be reached when its entire indebtedness will be retired. This will be true if depreciation and maintenance have been provided for in the operating expenses as well as interest and sinking fund on the indebtedness.

Munitions of War from Canadian Sources

THE manufacture of toluol has been commenced, for the first time in Canada, at the works of the Dominion Steel Company at Sydney, N.S. Toluol is a by-product of coke ovens, and is used in the manufacture of high explosives. The production of lead in Canada for war purposes has now reached 60,000 tons. It comes from Trail, B.C. Consideration is still being given to the proposal to refine copper in Canada, and it has been pointed out that the freight rate on copper matter shipped to the United States refineries is $10 a ton, in addition to duty. Refined copper is also subject to a duty on re-entering Canada. It is believed that the establishment of a copper refinery in Canada would serve as a regulator over foreign combines.

A peculiar penstock failure occurred recently at a station in northern New York. A 9-ft. steel penstock, 2,000 ft. long and under 200 ft. head, supplied two generating units, but had no surge tank connected to it. Two inclined branch pipes, closed with blank heads, were left for supplying future machines. Pressure-relief valves were depended on to prevent excessive water-hammer and assist in the speed rgulation of the generating units. From some unknown cause an extreme surge was set up in the penstock, and the hammer blew off the blank cover of one branch pipe. A 3½-ft. stream shot up, broke through the roof, and spouted in a curved jet which excavated a big hole in the ground some distance away. The plant was temporarily flooded, but the damage, except for the hole in the roof, was much less than might have been expected.

Collections of garbage are made bi-weekly in the business and weekly in the residence districts of Victoria, B.C. In the business districts a charge of 8 cents per can of 3½ cubic feet is made for collection; but this does not cover the cost, as the whole district has to be gone over, while collections from a large number of houses are still made by private scavengers. Recently a Peerless truck has taken the place of five carts in collecting and has resulted in a saving of labor cost of about 15 cents per ton. The average cost of collection of garbage from the residential districts, on the basis of one cubic yard weighing 1,350 pounds, has been $2.54 per ton, delivered at sea, as against $2.83 for the preceding year. These figures do not include overhead expenses or depreciation on equipment or buildings. The total collections for the year were 18,720 tons.

The power house, dam and transmission line were constructed by the Hawkesbury Electric Light and Power Company, by day labor. The power house switching equipment was supplied and installed by the Canadian Westinghouse Company. Generators, transformers and exciters were supplied and installed by the Canadian General Electric Company. Water-wheels were supplied and erected by Canadian Allis-Chalmers, Limited. The submarine cable was supplied and installed by the Canadian British Insulated Cable Company.

The Consulting Hydraulic Engineer on the work was Mr. Wm. Kennedy, Jr., of Montreal, and Mr. L. A. Herdt, D.Sc., was the Consulting Electrical Engineer, assisted by Mr. E. Godfrey Burr, Electrical Engineer, Montreal.

Power house under construction.

Construction of Power House and Dam at Cedars Rapids, Que.

ONE of the outstanding features of the industrial growth of Montreal has been the rapid demand for electrical energy for lighting and power purposes. The city is in the fortunate position of having excellent water powers within comparatively easy distances, allowing of low cost of operation and cheap energy to the consumer. By far the most important scheme of recent date is that carried out by the Cedars Rapids Manufacturing and Power Company, in which the controlling interests are held by the Shawinigan Water and Power Company and the Montreal Light, Heat and Power Company.

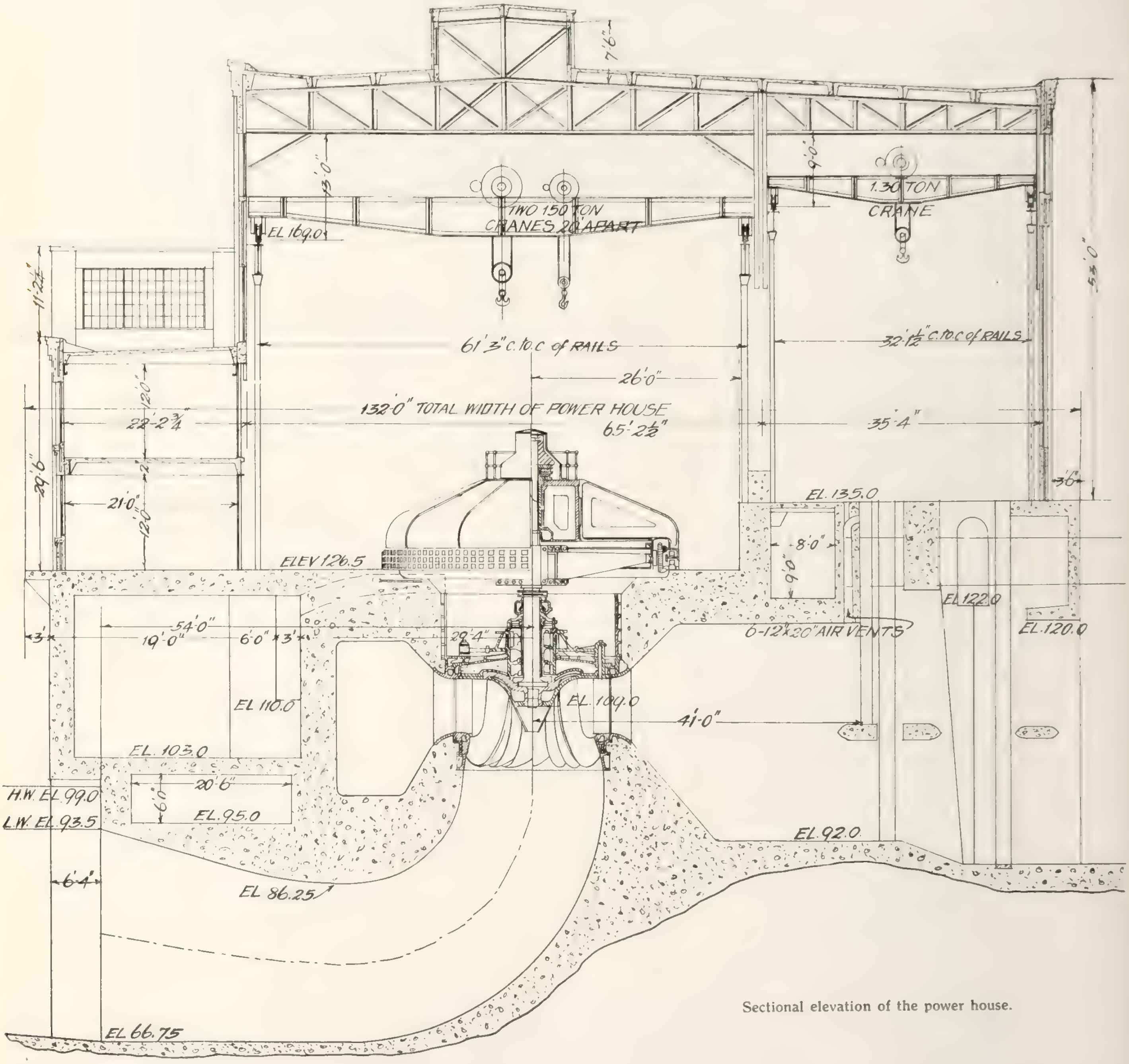
The development is at Cedars Rapids, on the north side of the St. Lawrence River, near the village of Cedars, about thirty-five miles west of Montreal. The Dominion Government granted a lease dated January 6, 1906, authorizing the company to take from the flow of the St. Lawrence an amount of water equivalent to 56,000 cubic feet a second, sufficient to develop a total amount of 160,000 horse-power. It was also found necessary to submit the plans to the International Waterways Commission, in order to avoid any interference with the provisions of the treaty with the United States Government, under which any diversion of the waters of the St. Lawrence must have the consent of the Commission. This consent was given on April 19, 1909. The water rights at the point are in the hands of the Provincial Government, and on August 2, 1910, a lease from this Government was signed.

Prior to the drawing up of plans an immense amount of work was done in the way of securing data as to the flow of the water. It was established that the flow is remarkably steady, the ratio in the highest and in the lowest years being three to one. At low water the flow of the St. Lawrence is in the neighborhood of 170,000 cubic feet a second, and the normal minimum flow is about 350,000 cubic feet a second. The minimum head of the plant occurs at low water. The minimum which has occurred during the last fifty years is 30 ft. The extreme fluctuation, taking into consideration the available data, would be from a minimum head of slightly over 29 ft., when operating under full load with thick ice covering in the canal, to a maximum head of about 34 ft. at a time when the plant is shut down through any cause, with no water flowing in the canal, combined with extreme high water conditions in the river. An exhaustive study of the

Tailrace and power house from the east.

fluctuations in the head at the point where the power house is situated has demonstrated that the formation of ice in the river affects the head at the plant only slightly.

In order to avoid interfering with navigation on the St. Lawrence, the plans were drawn so as to use part of the river as a canal. The power development covers an extent from east to west of a little over two miles. The northerly bank of the river is used as one side of the canal, while the south side of the canal is constructed at a distance of about 900 feet from the bank. A small island—the Ile-aux-Vaches—forms the upper end of the south bank, which extends to the power house at the downstream end. This south bank lies wholly in the river bed, a considerable portion being in very swift water. Before the construction of this dyke water flowed round the Ile-aux-Vaches; the amount of water flowing between the Ile-aux-Vaches and the mainland at low water of the St. Lawrence was in the neighborhood of 80,000 cubic feet a second. As the amount of water granted by the Government license is a little over 56,000 cubic feet a second, the difference of 24,000 cubic feet a second is forced to flow through other channels of the river.



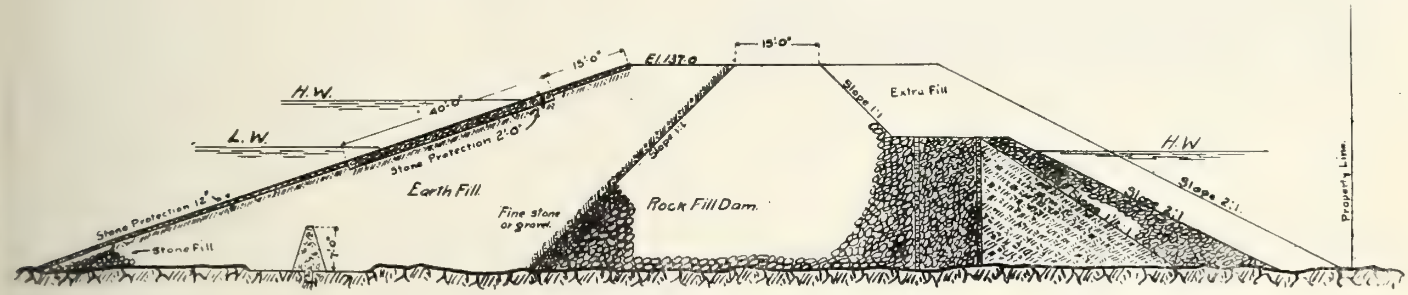
Sectional elevation of the power house.

The method of construction of the south bank was as follows: The crib work was constructed through the rapids and filled with stone. This crib work was sheeted on the outside and the sheeting made tight, and the whole strip lying between the crib work and the natural shore of the river was pumped out. The material was deposited behind the crib work, and the bank gradually built up. Finally a trestle was constructed in the centre of the bank, and rock fill was dumped off from the trestle. After the rock fill had been completed the earth blanket on the canal side was proceeded with. Before the construction of the bank the river bed was stripped over a section of the south bank and the core wall was built in this excavation, with the object of increasing the creepage distance under the bank and of making a tight connection to prevent the possibility of leakage. On the front face of the rock-fill selected clay was placed, washed down with streams of water. When the clay had consolidated, the outer layer of rock riprap, consisting of selected stones, was placed by hand.

In order to use the bed of the river it was necessary to straighten out the north shore line by cutting off the salients. By the removal of these points, and with the excavation in the canal necessary to bring the bottom to the proper level, sufficient material was provided both for the south bank and to construct dykes along the north bank at points where the natural levels were not sufficiently high to take care of the water conditions.

The same general type of construction was used in these dykes in the north bank, although in general they were much smaller and consisted only of short lengths to cross gulleys. A drainage ditch was constructed along the whole length of the north bank for the purpose of drawing off any water which formerly flowed into the river, carrying this water to a point below the power house. In the excavation of the canal and the construction of these banks 1,730,000 cubic yards of earth were handled and 650,000 cubic yards of rock (place measurements).

In order to concentrate the pressure of the water on the water-wheels, it was necessary to construct a dam at the end of the canal. This dam forms the foundation of the power house, the water-wheels being set in the dam itself.



Cross section of the dam at the south bank of the canal.

The following are the dimensions of the canal: width at bottom, 600 ft.; side slopes, practically 3:1; width at top, 800 ft.; depth of canal at minimum stages of St. Lawrence, 30 ft. The velocity of water under the worst conditions of low water and ice covering is 4 ft. a second, and the calculated loss of head in the canal under these extreme conditions is about 1.5 ft.

The power house is located across the end of the canal. It is of steel and concrete construction, built on the unit system, which was described in detail in a previous issue of The Contract Record. The slabs were cast in a casting yard about a mile from the site, and set in the steel frame by means of a crane. The walls are 12 ins. thick, consisting of two 4-in. reinforced concrete slabs, with air spaces of 4 ins. between. The substructure is 700 ft. long and 130 ft. wide. In this substructure are moulded the scroll cases for the ten main units and three exciter units. The draft tubes are also moulded in this concrete. The water-wheel units are of the vertical single runner type; they develop about 11,000 h.p. under a head of 30 ft. These wheels operate at 56 r.p.m., driving a 60-cycle, 6,600 v. generator located just above the water-wheel. On the top of the generator rests the thrust deck, supporting the thrust bearing above. The total weight of the rotating parts is about 550,000 lbs. The exciters are of similar design, but have a rating of 1,200 kilowatts. At full load the main units will require 3,700 cubic feet a second, and the exciter units 550 cubic feet a second.

The governor system is operated from a central pumping station situated near the centre of the power house. The pumps are six-stage centrifugal pumps, each capable of delivering 1,100 gals. a minute at 200 lbs. pressure. The pumps are operated by 250 h.p., 2,200 v. induction motors which take their power from the exciter generators. In addition there is a low pressure pumping plant to furnish water for cooling the bearings and also for supplying water in the transformer house for cooling the transformers.

The generators are located on the shaft, immediately above the water-wheels. In order to support the weight of the whole rotating mass, consisting of water-wheels, shaft, and generator rotor, a thrust bearing is provided on the top of the generator. This bearing is carried on a bridge-like structure. In order to hold the shaft steady two guide bearings are provided, one being immediately above the water-wheel near the bottom of the shaft, and one immediately beneath the thrust bearing at the top. The lower bearing is of the lignum vitae type, lubricated with water; the upper bearing is of the standard babbitted type, lubricated from the oil-pressure system.

The location of the thrust bearings at the top of the generator is of considerable importance, and is a somewhat new departure for a plant as large as that at Cedars. By this method it is very accessible for inspection and repairs, and the cost of the whole power house was lessened considerably.

The generators have a capacity of approximately 10,000 h.p. each. They deliver electrical energy in the shape of 3-phase, 60-cycle alternating current, at a normal voltage of 6,600. These generators are exceptional in their dimensions, the diameter of the rotor being 32 ft. The height of the machine is only 2 ft. 9 ins.

The electrical equipment conforms to the usual standard in plants of this description. The main control desk is in a gallery on the west side of the power house, and the control for all the machines is centred on this control desk. The power is taken from the power house to the transformer house, which is situated on the bank of the river about 850 ft. from the power house. In this transformer house are the step-up transformers for raising the voltage for long distance transmission. The switches, both high and low tension, in the transformer house are controlled from the control desk in this building.

Nine main units are now in operation. Measurements have been made of the power output of these machines at full gate, and they have been found to fulfil their specifications.

The transformer house, built of reinforced concrete, consists of four storeys, and is 86 ft. wide by 220 ft. long, and 90 ft. high. The house contains six 8,000 kw. transformers for stepping up the current from 6,600 v. to 110,000 v. for the Messena, N.Y., line, and three transformers of 5,000 kw. each for stepping up the current from 6,600 v. to 66,000 v. for the Montreal line. In addition to those mentioned there is a spare of each kind provided.

In the upper part of the transformer house are located, in duplicate, the high tension bus bars for both the 110,000 and 66,000 volt current. On the first floor are the oil switches and the bus bars for the 6,600 volt power from the power house, and also the usual switchboard and instruments controlling the low and high tension switches in the transformer house.

Setting one of the transformer house columns.

In both the power house and the transformer house every care has been taken to make the structures as fireproof as possible. With the exception of a few doors in some inside partitions, no woodwork is used in either the power house or transformer house, and no combustible material is used in the erection of either building.

In addition to the apparatus referred to, motor generator sets to provide the direct current for the excitation of the fields of the generators have been installed. This auxiliary apparatus is operated by three 1,500 h.p. water-wheels, driving three generators of the same size and providing 60-cycle alternating current at 2,200 v.

The gate house is situated on the upstream side of the substructure of the power house. In this section are installed racks for keeping foreign material out of the water-wheels, and the head gates by which the water can be shut from the water-wheel chambers and repairs to the water-wheels carried out.

Great precautions have been taken against ice. Two spillways have been provided on the south bank, and by opening the gates water and ice can be passed out of the canal into the river; ice passages are also provided through the power house. It is expected that frazil ice, after passing the rocks, will be swept through the water-wheels, the openings being 8 ft. high and 2 ft. wide.

Although work on the plant was commenced in June, 1912, little was done until the following September. Practically the whole of the following year was spent in installing the construction plant, a contract having been made in the spring with Messrs. Fraser, Brace and Company for the whole of the work with the exception of the power house superstructure and the transformer house. In order to facilitate construction and installation, lines were constructed from the site of the development to the Soulanges Canal, half a mile distant, and loaded cars were brought down the canal on barges from Couteau Junction. The material and machinery were then transported over the contractors' lines to the site. By November 1, 1914, the work was completed, and on November 5 the first exciter was turned on. On January 1 all the plant was ready to receive load. The present installation is only intended to develop 100,000 h.p., but it is capable of being extended to bring the total capacity up to 160,000 h.p. The company is supplying 60,000 h.p. to the Aluminium Company of America, and 20,000 h.p. to the Montreal Light, Heat and Power Company.

The executive committee appointed by the Board of Directors consisted of: Mr. Howard Murray, Vice-President; Mr. J. S. Norris, Secretary-Treasurer; Mr. Julian C. Smith, Hydraulic Engineer; and Mr. R. M. Wilson, Electrical Engineer. The direction and control of the construction work was entirely in the hands of this committee. Two other well-known Montreal engineers were connected with the work in a consulting capacity—Mr. Henry Holgate as Consulting Hydraulic Engineer, and Mr. R. S. Kelsch as Consulting Electrical Engineer.

The general contract was carried out by Fraser, Brace and Company, Montreal, the superstructure of the power house and the transformer house being erected by the Unit Construction Company. The other contracts were:—six 10,000 h.p. and three 1,500 h.p. water-wheels, I. P. Morris, Philadelphia; three 10,000 h.p. water-wheels, Wellman, Seaver, Morgan Company, Cleveland; governors and governor pumps, I. P. Morris; generators, exciters, low tension switching, and switchboards, General Electric Company, Schenectady; lubrication, Petersen Engineering Company, Milwaukee; head gates, Structural Steel Company, Montreal; racks and steel superstructure, Phoenix Bridge Company; gate hoists and cranes, Whiting Foundry Company, Harvey, Ill.; auxiliary transformers, Canadian Westinghouse Company, Hamilton, Ont.; dredging, Simpson Bros., Montreal.

Power house under construction—view from the south.

The contractors' equipment, which included the following, will give a good idea of the extent of the job:—Shovels—four 70-ton Bucyrus, three Model 60 and one Model 75 Marion; engines—fourteen 25-ton Montreal Locomotive Works, five 25-ton and one 18-ton Porter, two 18-ton, three 25-ton, and one 35-ton

Vulcan; gyratory crushers—one No. 6 McCully, one No. 5 Symons, two No. 5 and one No. 7½ Traylor; pulverizers—one Williams and one Kennedy; one Hunt automatic coal railway; dump cars—160 K & J 6 yard, seven Continental 6 yard, 36 Western 12 yard; one Western spreader car; eight standard gauge flat cars; four 200 h.p. Canadian Ingersoll-Rand air compressors; forty Canadian Ingersoll-Rand rock drills; eleven 10-ton Terry & Tench stiff-leg derricks; twelve Beatty hoisting engines; six Beatty centrifugal pumps; three Lawrence Pump and Engine Company's direct connected motor-driven pumps; one Brownhoist 10-ton locomotive crane; one McMyler 5-ton locomotive crane; eight Mead-Morrison swinging engines; one Lidgerwood-Crawford dragline excavator of 50 ft. radius; mixers—five 40-ft. chain belt concrete, two 40-ft. Smith concrete, one 40-ft. Ransome concrete, one 25-ft. Smith concrete, and one Ransome grout; four Hayward "orange-peel" buckets; three Beatty clamshell buckets; sixteen Schell concrete cars; bottom dump concrete buckets—four Insley, 16 Steubner, 4 Acme; 1 Leyner drill sharpener; one dump cableway, 1,800 ft. span, supplied by the United States Steel Products Company; dynamite—Canadian Explosives Company; cement—Canada Cement Company; electrical equipment, motors, etc.—Canadian General Electric, Allis-Chalmers, Bruce Peebles, and Wagner Companies.

Defining the Nature of Asphaltic Concrete

COMMENTING on the lack of definiteness in the meaning of this term, and the desirability of limiting the character of mixtures to which it is applied, the Municipal Journal notes that asphaltic concrete is coming into a degree of popularity that makes it highly desirable to identify this form of pavement by more definite standards than now exist. Asphaltic concrete in one city may mean a sheet asphalt surface mixture with the addition of 8 per cent. of 2-mesh and less than 20 per cent. of 4-mesh stone. In another city the mixture may be a rough-and-ready combination of 40 per cent. of sand and 60 per cent. of stone. One of the more carefully prepared specifications contains the following provisions:

> Sand: The sand shall be a natural bank or river sand, all of which will pass a 10-mesh screen. On sifting, at least 15 per cent. shall be retained on a 30-mesh screen, and at least 22 per cent. shall pass an 80-mesh and be retained on a 200-mesh screen.
>
> Stone: The crushed trap rock shall all pass a screen of 2 meshes to the lineal inch and all be retained on a 10-mesh screen, or a run of crusher trap rock can be used provided the portion passing the 10-mesh screen is of suitable grading to serve as sand and filler, in which event only sufficient sand and filler will be added to insure the proper proportion of sand and filler in the mineral aggregate.
>
> Filler: If the screenings do not contain sufficient 200-mesh particles, they shall be supplied by the addition of a suitable amount of ground limestone, or any other mineral matter (or Portland cement) of sufficient density to produce a powder having a volume weight when ultimately compacted of at least 90 pounds to the cubic foot. It shall be so fine that at least 75 per cent. shall pass a 200-mesh screen.
>
> Combining Materials: The sand and rock complying with the above specifications shall be combined in such proportion that the finished mixture shall contain not more than from 8 to 22 per cent. of aggregate passing a 4-mesh and retained on a 10-mesh screen and less than 10 per cent. passing a 2-mesh and retained on a 4-mesh screen.

An aggregate such as that described in this specification might be more correctly denominated a stone-filled asphalt mixture rather than asphaltic concrete. The name, of course, is not important so long as we know what it means; but when a pavement is described as asphaltic concrete the term ought to convey something definite to the mind. This cannot be the case so long as a mixture such as that just described is called asphaltic concrete by one engineer while another applies the same term to a mixture consisting of ½ to 1¼ inch stone and from 10 to 15 per cent. of sand of an unspecified grading. We should at least distinguish between "fine asphaltic concrete" (meaning a standard sheet asphalt surface mixture with the addition of fine stone) and "asphaltic concrete" of the type that is perhaps more exactly described as asphalt macadam, the former being a stone-filled sheet asphalt mixture, and the latter a stone mixture to which there is added a small proportion of sand.

About the oldest examples that can be found of asphaltic concrete that has been laid in any considerable quantity are in Buffalo and Rochester, N.Y. This type of pavement has been used in these cities for more than ten years. As described by the contractors, who have laid a large yardage in Rochester, the mixture is of the following composition:

Composition.	Original mixture.	Finer portion.
Bitumen	8.9	11.1
200-mesh	12.3	17.1
100 and 80-mesh	10.8	15.0
50 and 40-mesh	24.2	33.7
30, 20 and 10-mesh	16.3	22.7
4-mesh	21.5	....
2-mesh	5.4	....
	99.4	99.6

It will be observed that this mixture contains a considerable proportion of 200-mesh material, and comes within the definition "fine asphaltic concrete." So also does the mixture laid in Riverside Drive, New York, in 1913. The latter pavement has given an excellent account of itself so far under very trying conditions of traffic, It is not to be assumed,, however, that asphaltic concrete, consisting of haphazard stone and sand combinations, and without a sufficient amount of fine material, will give the service that can be obtained from the mixtures more properly described as stone-filled sheet asphalt.

For some years the composition of asphaltic concrete mixtures was governed more or less by the terms of the decision of Judge Pollock, out of which developed the so-called Topeka specification. The Topeka decision, however, did not assume scientifically to determine what would be an ideal paving mixture, but merely held that a certain mixture would not constitute infringement of a patent. It lies with those who are interested in the building of good pavements to see not merely that a patent is not infringed, but that a good paving mixture is obtained. The term "standard sheet asphalt paving mixture" now conveys a definite meaning. It is important that the term "asphaltic concrete" should have an equally definite meaning.

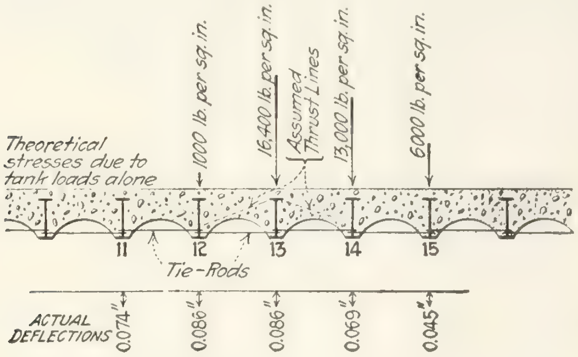
A Test of the Load-Distributing Action of Floor Arches

By Frank N. Kneas*

AN unusual test was made recently under the writer's direction—measuring the deflections the probable amount of stress in certain of several steel beams in a floor to discover beams. Some of the beams in this floor were to have concentrated loads placed on them, while adjacent beams were to be be practically unloaded; a change had evidently been made in the loading of the floor from that considered in the original design. The floor under the new conditions was to carry horizontal cylindrical tanks resting in cradles supported on pedestals, some of which would come directly over a beam. The question was, would the floor arches act in such a manner as to transfer some of the load from the high-stressed beams to the adjacent low-stressed beams?

The subjoined sketch shows a cross-section through the floor—20-in. 65-lb. I-beams spaced 38 ins. on centres and spanning 22 ft.; reinforced-concrete arches between the beams with rise of 10 ins., top of concrete about 4 ins. above the beams, and arch about 14 ins. thick at the crown.

Disregarding the bridging action of the concrete, the theoretical stresses due to the pedestal loads only ran up to 16,000 lbs. to a sq. in. for certain beams, while adjacent beams were apparently stressed as low as 1,000 lbs. to a sq. in. In one case the theoretical deflection at the centre was ⅜ in. for one beam and only 1/40 in. for the next beam. It seemed impossible that this could occur; more likely the concrete would "drag" the adjacent beams down with the heavily stressed beams, and thus reduce the stresses in the latter.



Floor tested for distributing action under heavy concentrations.

To get definite information on this distributing action, it was arranged to measure the actual deflections. Instruments were erected under about 12 beams, as well as under the girders on which the beams rested; the instruments multiplied the deflections by 20, so that it was possible to get very accurate measurements. The loading of the floor was very simple—it consisted of filling the tanks with water. The tanks were emptied after 48 hours to determine the amount of deflection that the beams would recover.

Inasmuch as the beams were spliced over their girders and the concrete around the top flanges of the beams acted as part of a T-beam, the actual deflections were much less than the figured deflections. Of course, the deflections for the dead-load were already in the beams before the tanks were filled, so that the deflections actually read were for the water loads only. Consideration was given to the deflections in the girders on which the beams rested, corrections being made in all deflections of the beams due to the deflection of the girders. But the corrected comparative deflections of the beams proved very interesting, and are shown in the sketch.

Although the theoretical stresses in the beams (the concrete not being counted as part of the section) differed so greatly, yet the deflections were very uniform. It is evident that a considerable portion of the load was taken through thrust lines similar to those dotted on the sketch to adjacent beams, and that thereby the load was distributed almost equally over the five numbered beams.

The test is interesting not only in showing the distributing action of such deep arches on such close spacing, but also as indicating that in more regular floor systems, such as terra-cotta arches between steel beams, there may be similar action tending to distribute heavy loads (such as partition loads) from one beam to adjacent lightly loaded beams.

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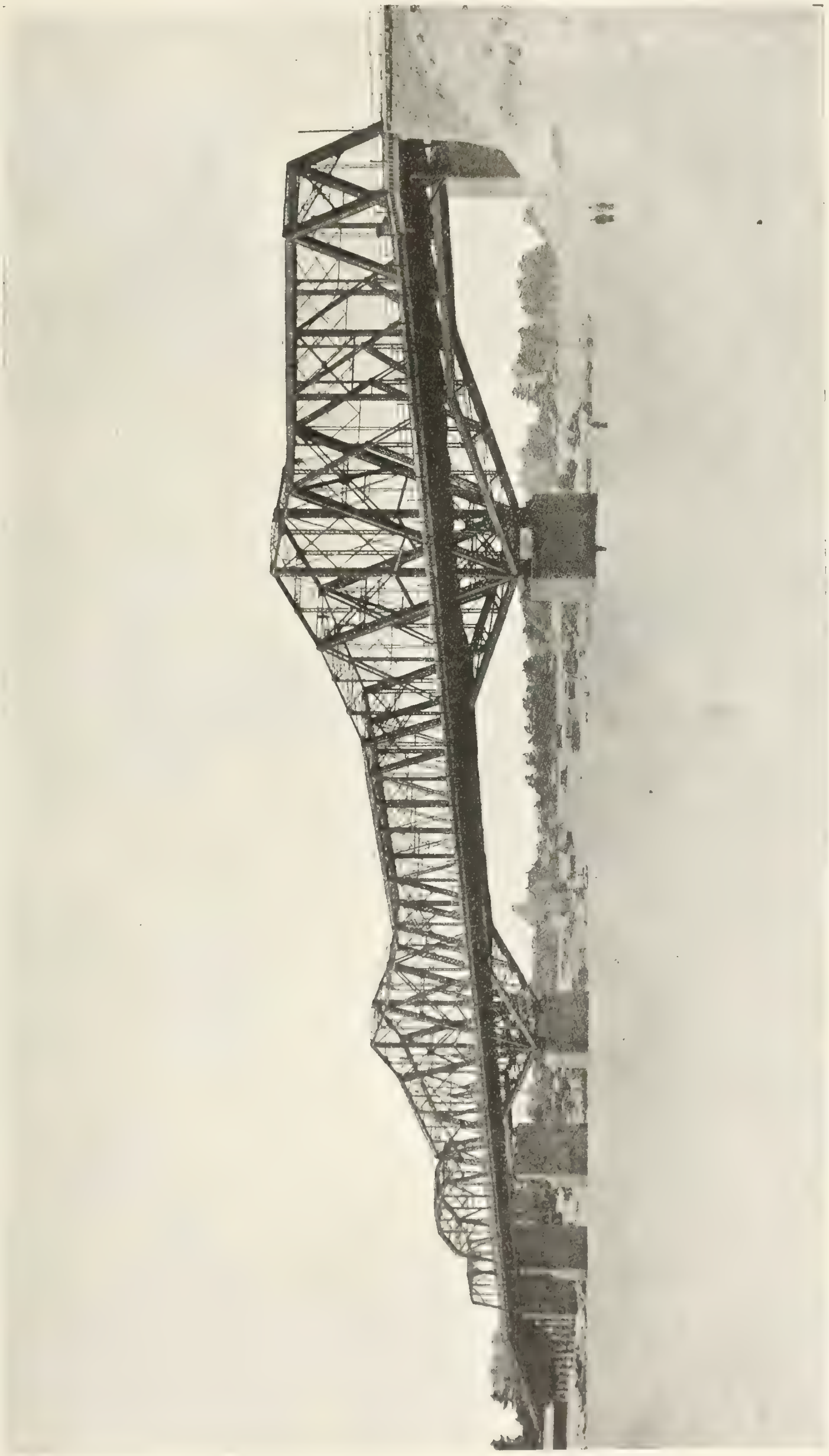
* Writing in the Engineering News.

The Alexandra Interprovincial Bridge, Ottawa

THE Interprovincial bridge across the Ottawa River was built in 1900, and was formally opened by King George the Fifth, then Duke of York. It received the name of the Alexandra Bridge, and, as the term "Interprovincial" implies, it connects the provinces of Ontario and Quebec. The bridge carries a single steam railway track and two electric railway tracks, besides two roadways and two footpaths. The railway track and the two footpaths are between the trusses, and the two electric railways are carried immediately outside the trusses. The carriageways are outside of the electric lines. Including the approaches, the total length of the crossing is 2,684 ft. 9 ins., and of this the bridge proper makes up 1,495 ft. 9 ins. This figure includes 1,049 ft. 9 ins. of cantilever structure, two truss spans of 247 ft. and 140 ft., respectively, and two short girder spans at the Ottawa end totalling 59 ft. The weight of the entire structure is 3,809 tons.

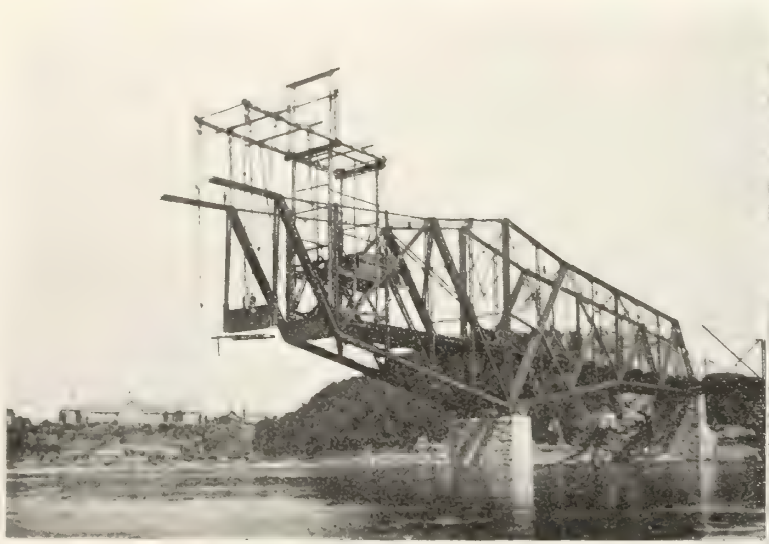
The erection of this bridge presented some unusually difficult features, due largely to ice conditions. Unavoidable delay in starting, coupled with unexpected trouble from frazil ice, compelled a change from the original erection scheme. The 140-ft. span was built on ordinary falsework between December 20th, 1899, and January 3rd, 1900, and upon it the traveller was immediately constructed. The 247-ft. span was then begun, using floating falsework. A Howe truss carried on four specially built scows supported in its turn bents of timber framing designed to act as falsework for each of the three 247-ft. spans, the two anchor arms, and the simple span. The floating falsework was placed ready for the 247-ft. simple span early in January, 1900, and by the 30th of the month the span was complete—that is to say, without the brackets, which were placed on all spans later in the erection.

The great trouble with the ice was now experienced, when it was hoped to be able to move the scows and falsework to the next opening, but it was February 23rd before they reached the desired position. The depth and consistency of the "frazil," together with the speed with which it rose and filled all the space

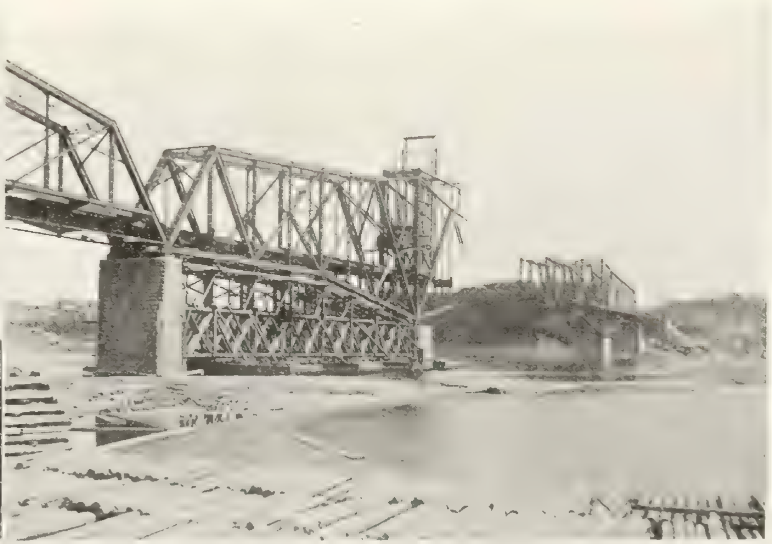


The Alexandra Bridge from the Ottawa shore.

Erecting Ottawa cantilever.



Erecting Hull cantilever.



Floating steel across the river.

Veiw from the Ottawa shore.

cut in the solid ice, combined to make the operation arduous and expensive, and it was decided to erect the lower chord, lower web members and floor system of this Hull side anchor arm clear of their true position, and then float them over to the Ottawa anchor arm opening, completing the erection of the Ottawa anchor span. The break-up of the river ice came late in 1900, and it was April 19th before the assembled steel could be moved across. The falsework was taken downstream, turned end for end, and towed upstream to its new position. The erection was then continued, and this span reached its final position complete and on the masonry on May 29th. The cantilevering from the Ottawa side was immediately proceeded with, and the centre of the suspended span reached by July 10th. On June 2nd the floating falsework was moved back to the Hull side anchor span, and this steel was erected when the traveller had been transferred by derrick scow from the Ottawa cantilever. The Hull cantilever was commenced on August 30th, and the last pin driven on October 7th, 1900.

The scows used in this work were launched at Lachine and towed up to the site of the bridge, carrying the timber for the falsework, trusses and bents, and all blocking, tackles, derricks, and other equipment. The four used in the floating falsework were each designed to carry 225 tons, consisting of the steelwork built over them, the traveller, blocking, falsework, etc.

The structure was fabricated and erected by the Dominion Bridge Company, of Lachine, Que.

Artificial Illumination in Relation to Architectural Effects*

By S. D. Chalmers, M.A.†

THE great progress in the theory and practice of artificial illumination has provided architects with new materials and resources for producing architectural effects, particularly in relation to the interiors of buildings and the decoration of halls and smaller rooms. It is true that the illuminating engineer has as yet made little progress in the application of his new methods to these purely architectural problems; it was only natural that he should first turn his attention to the more utilitarian aspects of artificial lighting; his aim has been to produce the illumination requisite for the comfortable use of a room for its ordinary purposes; and economy has been one of his prime considerations. He has, to a very considerable extent, solved the problem of the efficient and economical distribution of the light available. He avoids excessive illumination of any point, and by screening his sources of light reduces the glare, and so is able to obtain the same visual effects with reduced actual illumination. He takes into account the reflection co-efficient of his walls and ceilings, the nature of the objects to be illuminated, and the fineness of detail which must be distinguishable. Incidentally he has made some progress in the illumination of the architectural features and decorations of the rooms. But progress in this latter direction is more dependent on the architect than on the illuminating engineer. It is not always possible to make effective use of artificial light in buildings and rooms which have been designed entirely with a view to their effect in daylight. Just as the architect considers the site and lighting of his building in regard to its outside form and its interior decoration, so he should consider the scheme of interior decorations in relation to the artificial lightings with which it will be used. Some types of decoration are quite unsuitable for artificial illumination and should be avoided in rooms which are intended to be used almost exclusiely in artificial light. Other types are suitable for either illuminant. But the differences between the characteristics of daylight and artificial illumination are such that one cannot assume that good results will be obtained by artificial light, even though the results by daylight are most satisfactory.

But under the term of artificial illumination we include such varieties of actual lighting that much may be done to improve the effect in any given case.

It is my object to point out the fundamental similarities between natural and artificial lighting, to indicate how variations in natural lighting have led to important architectural developments, and to show how the results achieved with natural lighting may indicate the successful treatment with artificial lighting.

The great contrast between the Classic and Gothic styles is closely associated with the variation of the lighting conditions. In Greece the conditions were simple—a bright source of light almost always available, and a relatively small amount of diffused light. In the sunlight clear-cut shadows were produced, and only shallow mouldings were necessary to secure the necessary contrasts of light and shade. This is well illustrated in the columns of the Parthenon, where the sharply undercut mouldings produce clear sharp bands of shadow. But when buildings in the Classic style are erected in climates like our own the quality of the light is different, and the features must be modified if the same effect is to be produced; and the proportion of diffused light being greater, it is necessary to deepen the flutings to produce sufficient contrast. This same general characteristic is noticeable in artificial illumination when one bright source is replaced by a number of small ones.

It is this same effect of deeper mouldings and flutings that marks the Gothic as contrasted with the Classic architecture, and once more it is the lighting conditions which determine the extent of the change; the more diffused the light, the deeper must be the moulding. Another case of adaptation to the lighting is the pulvinated frieze, in which the surface is lightly curved, so that the upper part intercepts more light than it otherwise would do, and so gives a shading from the bright upper to the dull lower part. This is effective in the case where the light is well diffused, but comes only from a comparatively restricted sky area. This is an intermediate case between the direct sunlight and the wholly diffused light.

These same general principles apply also to interior ornament. The more diffuse and less direct the lighting, the more is it necessary to intensify the mouldings, carvings and other relief. When the lighting comes from above in a comparatively narrow beam, the ornament must be in low relief, while a general diffused lighting from in front is more suitable for cases of deeper relief. An illustration of this principle is furnished by the Miserare seats, with the low relief above and deep relief below. In most cases of artificial lighting, ornaments on the level of the lights may be in deeper relief than those well above or below. In the same way it is unwise to illuminate a ceiling with deep moudings by lights placed too close to the ceiling, as this results in long and deep shadows. When the lighting is very diffuse, it is sometimes preferable to produce the impression of depth by special devices, such as the linen-fold panel of the English and Flemish architecture of the fifteenth century. Such devices are usually suitable for artificial as well as natural lighting.

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* Paper before the Society of Architects.

† Head of the Department of Technical Optics, Northampton Institute, England.

Artificial Lighting of Interiors

Turning now to the possibilities of the artificial illumination of interiors, we find that the conditions are in some respects less, and in others more, favourable than those of natural lighting. The daylight usually comes as diffused light from a comparatively large window area, producing very variable illumination throughout the room. It is exceedingly difficult to modify its distribution to any appreciable extent, and the amount is very variable throughout the day and year. On the other hand, the eye adapts itself very readily to the variations of daylight, ignoring all excessive contrast and accepting the variations in colour of the light without noticing them. Not the smallest advantage, perhaps, is that the actual source of light does not come into view, and we are not obliged to devise special methods of screening it.

In the case of artificial illumination the original sources are comparatively small bright objects which obtrude themselves most unpleasantly if we omit to screen them from direct view. But because the sources are small we can surround them by diffusing screens or reflectors, and materially modify the distribution of the light coming from each source. With modern, properly designed reflectors it is possible to produce almost any desired distribution of the light, from practical uniformity to concentration in comparatively small angles in any desired direction. By the judicious placing of the sources of light and the proper choice of reflectors we can obtain, almost any desired distribution of the light with one limitation, that the light coming from each individual source to any point will be coming in a comparatively small angle. Each source would tend to produce well marked deep shadows, and care must be taken that the effects of the other sources are to reduce the depth and size of these shadows to the desired amount. In this way the shadows may be made architecturally useful rather than the reverse.

It is this possibility of varying the character of the lighting and the change in the distribution almost at will that makes it possible to obtain different architectural effects. The ideal of the illuminating engineer has generally been to produce even and soft illumination throughout the room. But it seems to me that this is not always the most suitable lighting, and that in some cases a more one-sided lighting, with a subsidiary cross or reverse lighting, might be usefully employed. In using this method one must not attempt to imitate the conditions of daylight too closely. The variations must be considerably less than those of daylight, because the actual illumination will usually be considerably below that which prevails with daylight, and at this lower illumination the variation is much more readily appreciated. This effect is not materially altered by actually increasing the illumination by artificial light, because of the dazzling effect of intense artificial light. Owing to the adaptation of the eye to the conditions prevailing in artificial illumination, comparatively small variations are effective, and it is unwise to produce strong contrasts between the different parts of the room. Most people find it unpleasant to sit in a well-lighted part of a room while the rest is in comparative darkness. It is on account of this adapt condition of the eye that it is so important to screen the modern sources of high intrinsic brilliancy, and the only effective way is to make the light appear to come from an area much larger than that of the source. The smallness of the size of artificial sources is troublesome when reflecting surfaces, such as varnished wood, are present, and in some cases the reflections are objectionable. They may be reduced by increasing the size of the source or altering its position. The same difficulty of reflection occurs in connection with picture lighting, and care should always be taken to place the sources sufficiently above the picture to make the reflection invisible at the ordinary level of the eye. This generally adds to the difficulty of securing even illumination on the picture, but by properly distributing the light from the source almost any required degree of evenness of illumination can be obtained.

Still further difficulties are encountered in regard to coloured ornamentation, and these troubles are accentuated if the illumination on the coloured object is low. The relative brightness of the parts of different colours will change as the illumination is diminished, and it is a wise precaution to secure abundance of light for any coloured ornamentation. Even with this precaution the colour values are unlikely to be exactly the same as with daylight, though the recent attempts to improve the colour rendering by artificial light have met with considerable success. But the rendering of variations of shade in a flat object is almost the same by artificial light as by daylight, and the same may be said of pierced work where the contrast of a carving is enhanced by piercing.

Pierced screens are interesting, as showing one of the earliest methods of combining natural with artificial lighting effects. In daylight the screen is lit from in front, the openings appearing dark to contrast with the screen; when the altar is lit up the screen is seen in silhouette, and the piercings are light. The same effect of interchange of light and dark in natural and artificial lighting is seen in the windows of churches and other buildings. The walls near the windows, which are of least importance in daylight, are the most prominent features in the artificial light. Their architectural treatment, though making little difference by daylight, may be of the geratest value for artificial lighting.

Diffused Lighting

But there are other methods of artificial lighting to which I would like to refer. In these methods attempts have been made to imitate the conditions of daylight lighting. An example is the use of a group of lights surrounded by large diffusing screens or reflectors, in imitation of the method of the oculus as used in the lighting of the Pantheon. It is easy in special cases to imitate the effect of this method of daylight lighting, and the method is applicable in large halls or theatres. But the method of indirect lighting approaches most directly to the effects of daylight.

In this method the light from the source is sent on to a white ceiling or screen and is directed downwards to illuminate the room. The absence of marked shadows renders this method useful for certain purposes, as, for example, the lighting of drawing offices, but unless the illumination is very high the method gives the impression of a poor imitation of daylight, suggesting coldness and winteriness. We interpret this artificial lighting, in terms of daylight and the suggestions that this daylight carries with it.

It is probably on this account that many people prefer the semi-indirect system of lighting, in which part of the light from the source is allowed to pass through the shade, while the other part illuminates the ceiling. In this case the impression of artificial lighting is retained and the camparison with daylight does not obtrude itself; at the same time the conditions of shadow are more those of daylight, and the indirect light from the ceiling tends to soften the whole lighting. This method of semi-indirect lighting is specially useful when the ceiling and frieze are worthy of attention in themselves, as, for example, in beautiful moulded ceilings.

In all these cases of indirect lighting it seems preferable to show sources which illuminate the ceiling even if the greater part of the light be really derived from concealed sources. There, are however, a number of cases where the ceiling has been lit entirely by means of concealed lights, and the effect has not been happy. These lights produce beautifully even lighting on the ceiling, but one unconsciously asks where does the light come from, and the only explanation is that there must be an opening between the walls and the ceiling, and apparently it must extend all round, there being no distinctive direction in which the light comes, and ceilings which are unsupported are uncanny. In one of these cases the effect was much improved by the use of a number of visible sources which apparently illuminate the ceiling. Thus, as regards interior illumination, the conditions are somewhat different for artificial and natural lighting. But each has its advantages, and by judiciously using the resources of artificial lighting it should be possible to obtain quite as good results as with natural lighting, but this is a matter for the architect as well as the illuminating engineer. New methods and arrangements of lighting are required.

In the cases where rooms are to be used only or mainly by artificial light, the architectural features should be designed in relation to the actual method of lighting to be employed. When few but large sources of light are to be used, the conditions approximate to outside natural illumination, and models of ornament and architecture may well be sought in Classical types; but when numerous smaller sources are to be used, the conditions approximate more to the Gothic conditions, and mouldings and ornamentation of this style might well be studied in connection with their value in artificial light.

Exterior Lighting of Buildings

Another interesting problem which I can only touch on lightly is the illumination of the exterior architectural features of a building. When the aspect is a southern one, the same conditions as in daylight may be approximated to by the use of one large source of light high up in front of the building, and a number of smaller sources placed lower down and distributed along the length of the building. When the aspect is a northerly one, the whole lighting should be by a number of small sources evenly distributed in front of the whole building. Occasionally friezes can be well lit by concealed lights above the frieze, the proper distribution of the light being secured by the use of suitably designed reflectors. In this case, again, the difference between the treatment of high and low relief is important, and the effect of the high relief is even more exaggerated for statues or very deep mouldings, which require front rather than high lighting.

The Position of the Engineer

THE following is part of an address delivered by Mr. Ira O. Baker, Professor of Civil Engineering in the University of Illinois, before a recent convention of civil engineers. It is reprinted from the Engineering News.

I am persuaded that the chief reason that the engineer does not attain to the position in the public estimation which he might occupy is because of wrong ideals. The representative engineer magnifies the importance of technical matters; in college he is insistent upon acquiring a so-called practical education—that is, he desires to specialize and to take only the subjects immediately connected with his chosen profession. As a consequence, he lacks breadth of view and is weak in knowledge of non-professional matters. Too often he has sought to perfect himself in technical details to the neglect of a knowledge of political procedure, of business methods, of labor conditions, or of social problems. Further, he is often seriously deficient in the ability to use correct language.

What, then, can the young engineer do to prepare himself for a wider usefulness and a larger success? I have several definite suggestions:

> By continual care and practice, cultivate the ability to express yourself in writing and in speaking in clear, concise, correct English. There is nothing more necessary to the young engineer who desires to attain more than a mediocre success.
>
> Extend your horizon by reading and by the study of industrial and political history, political and social science, economics, labor problems, and other vital subjects.
>
> Do not become a man of technical details nor a man of books to the exclusion of a knowledge of affairs. The successful engineer must buy materials; therefore he must have a knowledge of market conditions and of business methods. A successful engineer directs the labors of others; therefore he must know much of the motives that influence men, and must understand the point of view of organized labor, and should have at least some knowledge of the advantages and disadvantages of the different methods of payment. An engineer is frequently called upon to report upon projects; therefore he should be able to foresee all the industrial, commercial and financial conditions involved in the project, and should be able to accurately discriminate as to the relative importance of the various conflicting factors. The engineer writes specifications and makes contracts; therefore he should know something of the intricacies of the law.

Comparative building statistics of the city of Montreal just issued are as follows: 282 permits were issued in May, 1915, as against 716 in May, 1914. The value of the permits issued in May, 1914, was $2,517,148, against $529,167 for May, 1915. From January 1 to May 31, 1914, 1,823 permits of a total value of $6,578,314 were issued, and in the same period of 1915 948 permits were issued, of a value of $2,517,994.

A Modern British Columbia Fish Curing and Packing Plant

Concrete Floors Used for Cleanliness—Successful Insulation of Cold Storage Rooms

At Steveston, B. C., at the mouth of the Fraser River, a cold storage plant has been completed recently for the B. C. Packers' Association. It is one of the largest fish curing and packing plants yet erected in British Columbia. The buildings and dock cover an area of 250 ft. by 400 ft., and there is sufficient depth of water at the outer end of the dock to permit boats to land their cargoes of fish at all stages of the tide.

The main cold storage building is three storeys high, 105 ft. in width, and 125 ft. in length. This building is devoted entirely to frozen fish. There is also a side building refrigerated for the storage of mild cure salmon; this structure is 55 ft. wide and 125 ft. long, and two storeys in height.

With reference to the construction of the different cold storage buildings, an insulation consisting of a combination of air space, planer shavings and linofelt has been used with great success. This applies to all parts of the buildings, with the exception of the main floors, which are waterproof, and have a 4-in. insulation of cork in addition to the shavings and linofelt. This insulation has given such good results that this refrigerated space, having a volume of 550,000 cubic feet, can be kept at a temperature varying from 20 degrees below zero to 10 degrees above zero, with the use of one 30-ton refrigerating machine.

The fish shed on the dock is constructed with a concrete floor, this being for the purpose of cleanliness. The concrete floor extends over the entire area of the fish shed, which is 90 ft. x 125 ft. The cement finish is brought up around the walls and columns to a height of 2 ft., and the floor is also provided with a number of drains. In order to handle large quantities of fish, it sometimes happens that 100,000 lbs. or 150,000 lbs. are dumped at one time on this floor, and should the plant be busy at the time the fish can be mixed with ice and kept in perfect condition for twenty-four hours or more, and in this way the capacity of the plant is increased.

Exterior of Columbia cold storage plant.

The box-making department is situated above the fish shed, and has the same area. Here all the material used to manufacture boxes is stored, and also a great number of boxes made up and stencilled ready for use at any time. Shipments of fresh fish can be taken from steamers and loaded in cars on the company's side track in a very short time, as it is possible to pack the fish in ice, place them in the car, and ice the car at the same time from a platform above. If necessary, a shipment of 300,000 lbs. of halibut or salmon can be boxed, iced and placed aboard the cars in six hours.

Interior of a cold storage room.

The mechanical equipment of the plant is situated on the side next to the land, and comprises: 1 coal bunker with a capacity of 600 tons, 1 boiler room, 1 engine room, 1 room for auxiliaries, 1 room for ice tank, and 1 room for condensers, besides a space left for the office.

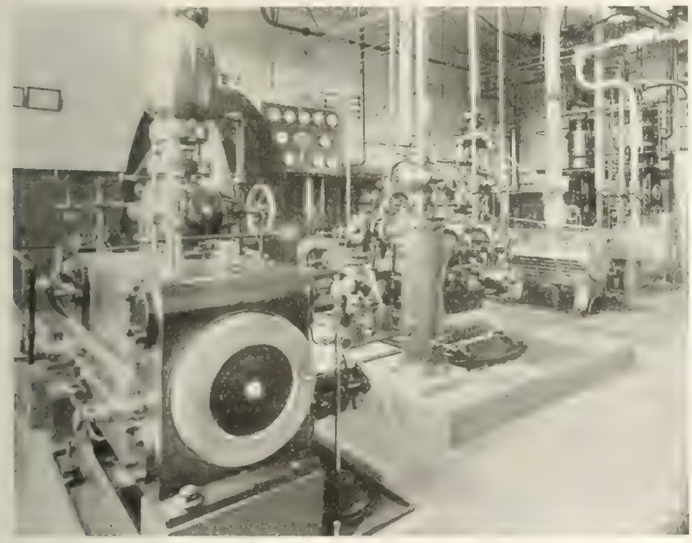
The main cold storage building is divided into storage rooms, work rooms and "sharp freezers." There are seven "sharp freezers," which have a capacity of 40,000 lbs. each, and here the freezing is done. The temperatures of these rooms are kept at about 20 degrees below zero, and the fish remain in these rooms until frozen entirely through. The freezing is accomplished by direct expansion pipes, and also by air blast. The freezers are equipped with a Sirocco fan, which displaces 25,000 cubic feet of air a minute. This cold air is kept in circulation, purified and washed, at the rate of 25,000 cubic feet a minute. After the fish have been frozen thoroughly they are removed to the glazing and packing departments, where they are dipped in fresh water and given a coating of ice. They are then wrapped in paper and placed in boxes to be stored in the rooms above until the time of shipment. The total capacity of the building for frozen fish is 7,500,000 lbs., and the capacity for mild cure salmon is about 1,200,000 lbs. The entire cold storage space is refrigerated by the direct expansion system, and for this purpose about 75,000 lineal feet of pipes are installed in the various rooms.

The coal bunker is situated adjacent to the boiler room; it has a capacity of 800 tons of coal, and is equipped with one steam hoist and derrick for transfering the coal from the scows to the bunker. Below the coal bunker are placed three tanks for the storage of fresh water; these tanks contain 36,000 gallons, which is a sufficient quantity to last the plant for ten days in case injury should happen to the city water mains.

The boiler room is equipped with two 150-h.p. return tubular boilers, and these are fitted with Jones underfeed stokers. One Weir boiler feed pump is supplied, together with a 400-h.p. Ideal heater and purifier. By using the heater and purifier the temperature of the water delivered to the boilers is at all times 210 or 212 degrees.

The engine room is equipped with three ammonia compressors of different sizes—1 60-ton horizontal, 1 40-ton horizontal, and 1 30-ton upright. This quantity of refrigeration is found to be quite sufficient for all the needs of the plant. The engine room is also equipped with two 25-kilowatt generator units for light and power, and also one small generator unit which supplies current for the elevators. One noteworthy feature is the placing of the elevator hoisting machine on the floor of the engine room, thus giving the engineer an opportunity to take care of it.

The ice tank is capable of manufacturing 18 tons of ice a day, and is situated over a section of the engine room, so that when the product is harvested the blocks can be sent by gravity in any direction to be used. This ice tank is equipped with an automatic air hoisting arrangement and a Curtis air compressor. The condensers are of a capacity of 200 tons refrigeration, and are situated above the ice tank. Water from the river is used, which at times is very brackish. The pumping is performed by a Weir service pump, size 9 x 18. Further pumping units are installed for emergency, and cross-connected to the pipe system of the plant.



Power house and refrigerating machinery.

The entire work was designed, and construction supervised, by the Linde Canadian Refrigeration Company, Limited, of 37 St. Peter Street, Montreal, Que., and this firm also carried out the contract for the supply and installation of the refrigeration machinery.

The destructive effect of heavy wagon loads carried on narrow tyres, and its seriousness in connection with the upkeep of the roads, is called attention to by the State Highway Commission of Colorado in its recent biennial report. It is also pointed out that any method leading to the adoption of a law for a maximum load per inch of tyre, not to exceed say, 500 lbs., would result in a large saving in maintenance. The report contains a number of pages devoted to the width of tyres, and contains the practice of various States and foreign countries. It also includes comments on the subject by well-known authorities, covering a range of years.

The Use of Large Stone Chips in the Maintenance of Bituminous Roads

THE Maryland Highway Commission, of which Henry G. Shirley is Chief Engineer, after an experience with the maintenance of bituminous roads extending over several years, has adopted the practice of using stone chips at least one inch in size. The chips are spread over the surface of the road, at seasons of the year when the bitumen is soft, in an even layer one stone thick, and rolled. The rolling forces the stones into the surface of the road until they are flush with the pavement. When completed the surface has somewhat the appearance of a mosaic. Hard blue limestone is used, and has been found to be quite satisfactory for this purpose.

The reason for the method of maintenance adopted is obvious. It has been universally found in practice that small stone chips are either quickly ground to a powder by iron-shod traffic or are in a large measure swept from the road surface by automobile traffic. The use of sand is now quite generally avoided by maintenance engineers, on the ground that it tends to build a mat or pad that becomes unmanageable when thick, and also greatly increases the danger of waves in the pavement due to the pushing of the bituminous surface occasioned by the continual passage of automobiles, usually travelling in a single direction on one side of the road.

While this method of surface maintenance—or, more properly, surface improvement—is not new from an experimental standpoint—similar work having been done by Major Crosby, the former Engineer for the Commission—its application to road maintenance work on a large scale such as is in progress in Maryland is an innovation. From the standpoint of the road user it possesses advantages. The exposed stones roughen the surface and reduce the slipperiness of the pavement. Slipperiness has always been a fault of bituminous treated country roads, especially since many of the horses that travel them are not sharp shod. The danger of automobiles skidding is also reduced. From the standpoint of increasing the life of the road the reduction in slipperiness permits the use of a relatively higher crown, thereby insuring thorough drainage of the surface and increasing the durability of the road, the practice of most road engineers being to use as much crown as limiting conditions will permit. In this connection it may be said that experience has demonstrated in the city of Washington that asphalt streets and roads built with a high crown have usually a longer life than those streets or roads on which less crown is used.

While the labor cost of applying large stone chips in this manner is necessarily increased somewhat, the road surface is improved by the thorough ironing out it is given by the roller. The greater availability of the supply of larger stone is also a factor worthy of consideration in many sections of the country. It is frequently difficult to secure an adequate supply of ½-in. and ¾-in. stone.

It is believed that the incorporation of large stone chips into the surface of the road is worthy of the consideration of engineers engaged in both maintenance and construction work. While difficulties are encountered, and careful workmanship is required, the results obtained are of sufficient value to warrant the additional cost.—Engineering and Contracting.

Methods and Costs of Plaster Lining of Irrigation Canals

By Calvin Casteel

THE following information dealing with the methods and cost of plaster lining on the Okanogan Project of the U. S. Reclamation Service at Okanogan, Wash., is contained in a paper in the Proceedings of the Washington Irrigation Institute.

This paper will only take into consideration the methods, cost and efficiency of plaster lining, such as has been done on the Okanogan Project. This lining for the most part has been put in the canals and laterals already constructed, and is one and a half inches thick. Practically all concrete has been mixed with a gasoline power concrete mixer.

Design of Cross Sections

The cross section of the concrete lining should be as near an ideal economic section as it is possible to make for new ditches, taking into account the cost of laying as well as the cost of the material. For ditches already constructed, with less than a 3-ft. base and 3 ft. in depth, an economic section can be designed by lowering the grade and backfilling on the sides without making the cost excessive; but if the water surface is fixed, as is generally the case upon ditches that have been constructed and in operation, it may be necessary to raise the sub-grade, which will make the backfill excessive and the cost per lineal foot more than for a section of wider base.

In practice it is not economical to build an economic section in small ditches, as the cost of preparing the base and laying the concrete will increase the cost out of proportion to the saving that is made in the amount of material used, as the bottom width is made too narrow to work in to advantage. This applies particularly to ditches having a depth of between 1 and 2 feet.

For all ditches over 1 ft. in depth it is not economical to plaster them without working in the bottom, and with the bottom width made so narrow that the plasterer can neither stand nor kneel without danger of tearing down the side slopes when he moves, and thereby causing extra work to fix them up as the plastering is done, which will increase the cost to a great extent either by additional help necessary or by delaying the concrete mixer and the balance of the crew.

The side slopes for plaster lining should not be steeper than 1½ to 1. A steeper slope requires the concrete to be mixed too dry to spread easily and to obtain an impervious finish without extra labor, and whenever the concrete is mixed a little too wet it will naturally run if laid on a steeper slope.

A berm not less than 4 ins. wide should be used on small laterals up to a depth of from 1 to 2 ft.; for greater depths this berm should be increased to 5 or 6 ins., and for side hills should not be less than 6 ins. for any size lateral, and may often need to be wider.

This berm not only serves to strengthen the top of the lining, but also prevents surface water from getting under the lining, when it is properly covered with earth after being laid. Ordinarily no harm would come from allowing any surface water to get behind or under the lining, but in the latter part of the winter such as we have at Okanogan, when the snow is going off, it may thaw very rapidly for one or more days and then freeze very hard, in which case, if the water is allowed to get under the lining, heaving will take place and considerable harm may be done.

When a ditch is all in a fill a minimum berm of 4 ins. may be used with safety, but along side-hills where there is considerable drainage into the canal a wider berm should be used; then after it is laid it should be well covered with earth. Where the water has been flowing into the canal in well-defined drainage channels, these should be taken care of by allowing the water to get into the lining by lowering the side of the lining from 4 to 6 ins., and widening the berm to sometimes as much as 2 or 3 ft., which will prevent the water from getting under and damage following.

Grade and Alignment

For small canals carrying 100 c. f. s. or less the stakes should be set so that they can be used for both grade and centre line. One stake set every 10 ft. is sufficient; this should be set on the sub-grade of the back-fill or the bottom of the lining, so that a template can be set on the grade hub, and the back-fill material placed so that it comes flush with the top of the hub. By setting the grades in this way it is not necessary to remove them when the concrete is put in place.

The grade and lines should be checked after the back-fill has been placed and flooded, and before the final finish to neat lines, which is done before the placing of the concrete.

Excavation for Back-Fill

Where a new ditch is constructed with the idea of lining immediately, it is constructed to fit the cross section of the lining which has been designed and which should be an economic section; but where the ditch to be lined has been constructed for some time, and has been in use, there is generally some sod to be removed at the water line. Even if it is economical to reduce the section, it is necessary to slope these sod berms so that the back-fill will not settle away from any part that might be overhanging.

The economical crew necessary on this work has been found to consist of a sub-foreman, with anywhere from 10 to 20 men, depending upon the size of the ditch and the amount of excavation to be done. The efficiency of the crew is cut down considerably if they are strung out over a long section of the ditch.

Two men go ahead with a template to which a carpenter's level is attached so that it can be kept level, and excavate trenches at each grade hub on the sides, and bottom, if necessary, these trenches being excavated to the neat lines of the section as it is to be before the back-fill is placed. The excess material between the trenches is then removed by the remainder of the crew. No straight edge is used on this work, as it does not need to be any more accurate than it can be made with the aid of the eye. It is perhaps needless to add that the template must be kept centred on the grade hub, and level when digging these trenches.

Hauling and Placing Back-fill

The material used for back-fill may be any material that is very pervious to water, so that in case of ground water getting under the lining during cold weather it has a chance to seep away before freezing can take place.

In places where holes of considerable size are to be filled, boulders and large rocks are used to fill in, if handy, and if not, sand or gravel is hauled for this purpose, a minimum thickness of three inches being used.

The back-fill should be hauled, and where possible dumped on both sides of the canal; where the back-fill is heavy it will pay to bridge the canal. All bridges built for hauling back-fill should be built high enough to be out of the way of the lining and left in place until the lining is completed, as they will come in handy to cross when stringing out the running boards, and also may be located so as to form part of the platform for the set up of the concrete mixer.

The amount of back-fill should be checked at each grade and the line hub with template, to see that the required amount is being placed.

Two five-man crews, each with a template, under one sub-foreman, have been found to be the most efficient sized crew to employ in placing this back-fill in the canal. Any number of crews, of course, can be used, with additional sub-foremen. All sub-foremen used in the preparation and lining must work.

Back-fill should not be hauled any faster than it is being placed, so as to avoid having an excess, or an insufficient amount in any one place.

Flooding and Finishing Back-fill

In order to settle the back-fill properly and give it a good wetting so that it will not draw all of the moisture from the concrete it has been found necessary that it should be thoroughly soaked by flooding before giving it the final finish. Only a small amount of water should be used in the flooding, and this should be let in slowly to prevent washing the back-fill off from the slopes.

If there are not enough permanent checks in the canal to enable the water to be checked up to within at least a few inches of the top of the back-fill, temporary checks should be constructed at necessary intervals. For small canals and laterals a sack dam has been found the safest and cheapest to construct and to remove, and serves the purpose better than any other temporary structure.

The dams should, of course, be constructed before the water is turned in, and then allowed to fill up and run over the top, so that the upper section can be well soaked, while the section next below is slowly filling. After all sections have been soaked thoroughly, the water should be let out slowly, in order not to carry away any back-fill, or cause any to slough down from the slope; there is a tendency for this to happen if the water is lowered suddenly. After the water has drained out, the finishing of the back-fill should be started as soon as possible, as the wet back-fill works better than after it has been allowed to dry out to any great extent.

In finishing, the greatest care should be used to see that the finished section is as near the theoretical section as it is possible to make it without too great an expense, as the capacity of the lined section may be reduced considerably if it is not carefully straight-edged, this being particularly true on ditches with a steep slope. Particular care should be taken with the corners, where the bottom and the side slopes meet, as a rounding corner will hold the plasterer's straight-edge away from the slope, and will not only make a kink in the alignment of the side slope and decrease the capacity of the ditch, but will increase the amount of concrete for the lining.

The crew for this work should consist of a sub-foreman with from 16 to 20 men; there should be three men with a template, who go ahead and set the template on the grade hub, and after it has been centred and levelled thin strips are inserted under the template on the side slopes for the straight-edge to slide upon.

The upper ends of these strips are set just even with the top of the template, and should be at least two inches longer than the side slope, so that they can be pressed into the back-fill in the bottom to hold them in place after the template has been removed.

(Concluded in next issue.)

Personal Mention

Mr. R. N. Young, Superintendent of the British Columbia division of the C. P. R. Telegraphs, is making an extended tour of inspection along the company's lines in the Nicola Valley and on the Arrow and Kootenay Lakes, in the Kootenay district.

Mr. R. S. Richardson, the new Superintendent of the Armstrong-Winnipeg section of the National Transcontinental Railway, has been in Winnipeg making preparations for the inauguration of a passenger service on this line. Mr. Richardson was formerly Assistant Superintendent of the Halifax and St. John division of the Intercolonial Railway, and has been in the railway business nearly all his life.

Mr. V. W. Horwood, Provincial Architect of Manitoba, has resigned, and since his departure for treatment at an American hospital Mr. H. E. Matthews has been acting in his place. Now Mr. Matthews has asked to be relieved of his duties, and Mr. William Fingland, a well-known Winnipeg architect, has been appointed Acting Provincial Architect. According to the latest reports, Mr. Horwood is still prevented by ill health from resuming his duties, and the date of his return is uncertain.

Mr. R. H. Burrell, Fair Wage Officer, has given a definition of the term "prevailing rate of wages," which is placed in all contracts of the city of Toronto, as follows:

"The union rate of wages, of course, is a fixed rate. At certain times the prevailing rate might be the same as the union rate, or, if labor was scarce, it might chance that the prevailing rate would exceed union rates. Scarcity of work would have a tendency to lower the rate at which men would be willing to work, and thus the prevailing rate would be less than the union rate. The prevailing rate is the rate most generally paid to workmen at any period, and it may vary according to labor conditions during the course of a year."

A number of representatives of filtration manufacturing companies have been in Brockville preparing tenders on the specifications for the construction of a new filtration system there in connection with the Brockville Water-works System. The companies represented include the Pittsburg Filter Manufacturing Company, the Norwood Engineering Company of Canada, the Roberts Filtration Manufacturing Company, of Derby, Pa., the American Water Softener Company, of Philadelphia, and Norman McLeod, Limited, of Toronto.

The biggest and the best railway map in Canada is that which hangs in the directors' room of the C. P. R. general office—a map 100 feet long by 10 feet high, which took the combined efforts of three of the cleverest men in the drawing department of the company eighteen months to complete. This map is minute and comprehensive to the last detail. Every inch of railway, every islet, rearing its head in the lake or river, every city and town and village, it might be said, in the whole of the Dominion, is limned in characters which, however minute, are entirely legible.

The double tracking is shown; the course of each system from its commencement to its ending set forth; nothing has escaped the faithful and able chartographers or monographers, if one may use the words, so that at a glance the high officers of the company may see the course of the system, the river, the lake, the mountain, the stream, in any part of the Dominion.

Mainly Constructional

East and West *From Coast to Coast*

The Deakin Construction Company, Limited, has been registered at Montreal. They will carry on business as general contractors.

The firm name of the Parsons Construction and Engineering Company, Limited, of Regina, has been changed to the Parsons Construction Company, Limited.

The Buckeye Machinery Company, of Calgary, Alta., have received a Government contract for twenty thousand shrapnel shells, and are securing additional machinery and tools for their manufacture.

The Alberta Hydro-Electric Power Company, Limited, of Calgary, is considering the construction of a series of six dams and power houses, estimated to cost two million dollars.

The Provincial Government of New Brunswick is calling for tenders for the construction of the substructure of the proposed new steel bridge over the Petitcodiac River near Moncton.

The station will be flanked to the east by a clock tower about 125 feet high. The entire station will be faced with stone. The architects are Messrs. Darling & Pearson, and the contractors are P. Lyall & Sons, of Montreal.

C. Degrelle, A. Morin, B. Pellege, E. Riberdy, and J. Rossi, all of Montreal, have incorporated The Degrelle Company, Limited. They will contract for all kinds of construction work. The capital stock of the company is $20,000.

Work has been started on the rebuilding of the brass factory of the Canadian Wolverine Company, at Chatham, which was destroyed by fire recently. The extension which was planned before the fire took place will now be carried out.

Alexander Craig, Limited, have been incorporated in Montreal, Que., by F. J. Craig, J. W. Brennan, G. T. Jenkes and J. Coppold, all of Montreal. The capital stock of the company is $50,000, and they will carry on a general contracting and building business.

The St. John Street Railway Company have completed the extension of their car line to Glen Falls, three miles from the city in an easterly direction. The track line along the East St. John harbor front is now partially laid, and upon the completion in August of the Provincial Government bridge across the Reversing Falls the company will be able to link up with the west side of the harbor, where a branch line has been operating for several years. These extensions will open up splendid residential and industrial districts.

Grant, Smith & Company, of Victoria, B.C., have taken out a Supreme Court writ against the Kettle Valley Railroad for $699,609, which they claim is due them on account of the construction of that railroad. The plaintiffs also claim interest on the balance due from October 21st, 1914.

B. & S. H. Thompson & Company, Limited, metal merchants, have removed from Transportation Building to McGill Building, Montreal, while the Canada Grip Nut Company, Limited, have taken offices in the same building, having removed from the Eastern Townships Bank Building.

With a capital stock of $300,000, the Dominion Road Machinery Company, Limited, has been incorporated at Goderich, Ont. The incorporators are W. L. Horton, J. W. Kitts, R. C. Hays, C. L. Moore, and S. J. Philips. The firm will manufacture all kinds of road and agricultural machinery.

Work has been started on that portion of the Dewdney Trunk Road between Stave Falls and Mission City, B.C. When completed this section will link up this important highway with the upper section of the North Fraser Valley from Harrison Bay to the cities of New Westminster and Vancouver.

Canada's only moving picture plant, at Swansea, Ont., was totally destroyed by fire last week. The owners were the Beury Film Company, and the loss is about $100,000, of which $20,000 is covered by insurance. The plant of the Indestructible Brick Company was damaged also to the extent of $15,000.

At Montreal, Que., the firm of J. Brunet, Limitee, has been incorporated to carry on business as manufacturers of brick, tile, terra cotta, plaster, artificial stone, and cement. The incorporators are L. A. Rivet, L. G. Glass, A. Papineau, G. Duclos and A. Tarte, all of Montreal, and the capital stock of the company is $100,000.

The Eastern Steel Company of New Glasgow, N.S., have received an order from the Imperial Government for forty thousand shells, ranging from 18-pound shrapnel to 60-pound 4.5-in. high explosive shells. The company are installing new machinery, by which they expect to treble their daily output by making six hundred shells a day.

Application has been made by R. M. Rive, A. C. Jardine, C. S. Hanington and A. H. Hanington, of St. John, and John H. Harris, of Moncton, N.B., for incorporation as The Moncton West Building Company, Limited, with capital stock of $24,000, of which $5,000 is to be preference stock. The head office will be at Moncton.

The Tupper Fire Escape Company, Limited, has been incorporated at Sherbrooke, Que., by W. Tupper, C. A. Stokes, W. F. Rosencrans, G. Layfield, J. C. Nowell, L. Landry, and F. E. Woodbury. The firm will manufacture fire escapes and other safety appliances for buildings. The capital stock of the company is $100,000.

A deputation from the Manitoba Good Roads Association waited on the Hon. T. H. Johnson, Minister of Public Works, recently. They asked for a continuation of the encouragement that had been extended to them by the Department, and were told that the Department proposed to still give its support to the work of the Association and that any request would be given due consideration.

Berlin's new garbage incineration plant was opened by Mayor Hett on May 28th. There was a representative attendance of municipal officials from Ottawa, Galt, Waterloo, St. Catharines, and other Ontario towns. The plant was built by the Ideal Incinerator and Contracting Company, of Toronto, who gave a demonstration at the opening, when the carcase of a horse was consumed in seven minutes.

The Montreal Builders' Exchange have decided to maintain the schedule of wages adopted in December, 1914. The schedule terminated last month, but the members are of the opinion that conditions do not warrant any change. At a special general meeting Mr. D. K. Trotter, the Secretary, reported that the finance committee had cleared off a substantial part of the liabilities standing at the beginning of the year.

The new Toronto Technical School has been handed over to the school trustees. It has cost over two million dollars, of which a quarter of a million was expended on the site. The equipment in the applied chemistry and plating laboratory is complete, but in the other laboratories the machinery and fittings are still being installed. The power house in the basement is now practically completed, and includes a vertical engine of 300 h.p. and a large horizontal engine.

It has been suggested that a solution of the Toronto Street Railway's difficulties in connection with the elimination of the running board may be afforded by the use of steel-frame cars, which are less bulky than those of wooden construction. Engineer Royce, of the Ontario Railway Board, is paying an official visit to Philadelphia to inspect cars of this construction at the works of the Brill Car Company. It is possible that cars of a similar type may be installed in Toronto if they meet local requirements.

The gross earnings of the New Brunswick Telephone Company for the year ending March 31st last were $455,066.53, as against $422,709.45 for the previous year. The net revenue, after paying operating expenses of $351,911.91, was $103,154.62. The receipts from the exchange service had increased from $274,111.23 to $300,763.50; and the toll service produced $145,159.94, as compared with $138,854.96 for the year 1913-14. There was an increase of 1,071 telephones during the year. The company paid the usual 6 per cent. dividend.

Satisfactory progress is being made on the work of installing concrete piers for the new Bloor Street Viaduct, Toronto. One pier has already been brought to grade. The City Inspector reports that the work is being done in full conformity with the specifications. It is not expected that any of the steel work will be placed in position this summer, as it will require the greater part of the warm weather to install the concrete piers, which applies only to the Don and Rosedale sections of the viaduct. The material from the excavation work on the Don section is being utilized to fill in the Bloor Street section.

The plant of the Heaps Engineering Company at Queensborough, B.C., is being prepared for the manufacture of shells. It is expected that the plant will turn out a minimum of a hundred shells a day, the daily output being increased as the work proceeds. The company will work on part of the order awarded recently to the Vancouver Engineering Works, who are acting as the distributing agents for the various manufacturers concerned in the deal. The Vancouver Engineering Works received an order calling for a minimum of 30,000 shells within six months, and the Heaps plant will handle at least 7,500 of this number.

An arrangement has been made between the Dominion Government, the Provincial Government, and the Pacific Great Eastern Railway in British Columbia to resume work immediately on that line. Plenty of money is on hand to continue the work up to the end of the year. It is expected that by that time 223 miles of the line will be in operation, as compared with the 120 miles now completed between Squamish and Lillooet. The contractor, Mr. P. Welch, will open an employment office in Vancouver, and will engage upwards of 1,000 men in order to carry on the work. The Provincial Government will appoint a man to attend to the office and to see that none but British subjects are employed.

Work has been begun on the excavation for the new Union Station of the Canadian Pacific Railway and the Canadian Northern Railway at Yonge and Cottingham Streets, which is to be constructed at an estimated cost of over $1,000,000. The station is to be placed immediately south of the C. P. R. tracks, east of Yonge Street. It will have a frontage of approximately 135 feet, and will be about 75 feet deep, with a spacious entrance driveway to the south of the building. A large baggage-room will be placed under the elevated tracks, and there will be a driveway along the east side of Yonge Street under the tracks for delivery of baggage. The main body of the station will contain the waiting-room, 50 feet by 75 feet, and about 32 feet high, with the ticket, telephone and telegraph offices to the west, and the men's and women's rooms, with lavatories, to the east. The tracks will be reached through a concourse and a midway under the tracks; from the latter five flights of stairs will lead to the platforms.

In connection with the Montreal filtration plant now under construction, plans have been drawn up for an electrical conduit system. The current will be supplied from the aqueduct, which has been enlarged for the purpose of developing power for the water-works pumping plant, lighting, and other purposes. It is proposed to install the necessary equipment at the station at Point St. Charles, and to make the requisite connection with the filtration plant. The conduit will be 2,000 feet long. The plans include branch lines to outside lamp posts along the main line of conduit. Each joint of the terra-cotta ducts is to be provided with wrought iron dowel pins. The uniform interior cross section of the vitrified clay ducts is to be 3½ ins. square, with walls not less than ⅝ in. thick. The standard length of the duct is to be 18 inches. The fibre ducts are to have an internal diameter of 3 inches, with walls not less than ⅜ in. thick. The ducts are to be laid in a 3-in. bed of concrete. Manholes are to be made at stated intervals. The contractor will have to install forty cable racks, each complete with five cable brackets.

A conference of the Mayors, Reeves and Councillors of the various municipalities interested in the Toronto-Oshawa road was held in Whitby last week. It was decided to follow the Kingston Road route, and the Government Engineer's report on the cost of the work was received and approved. The estimates were as follows: Reducing grades, $33,915.20; open ditches, $21,362.40; tile drainage, $11,290.60; culvert pipe, $7,230.85; catch basins, $1,254; concrete wing walls for culverts, $496; bridges and culverts, $52,356.52. The total cost of this part of the work is $127,905, and the whole scheme will entail an expenditure of $237,000, which will be divided among the following: York County Commission, Ontario County, Toronto, Pickering Township, Whitby West, Whitby East, Whitby Town, and Oshawa Town. A provincial subsidy of $57,840 is also provided for. The Hon. Finlay Macdiarmid outlined the policy of the Government in connection with the building of good roads. It was the intention of the Government to classify roads under the headings of county or market roads, main roads, and suburban roads, the latter term covering roads leading directly out of the cities through the congested districts. They would agree to pay forty per cent. of the cost of building these roads, and twenty per cent. of the cost of maintaining them. Mr. W. A. McLean suggested several different kinds of roads that would be suitable for the Toronto to Oshawa highway, but in view of the probable traffic demands he recommended a macadamized road to the Scarboro boundary, and an improved gravel road from that point to Oshawa. This recommendation was adopted by the meeting, and a committee was appointed to interview the various municipal bodies, and to prepare and circulate a petition among the rate-payers.

New Electric Clock at Birmingham, (Eng.) Post Office

The first electric turret clock to be purchased by the English postal authorities was erected recently at Birmingham General Post Office. The type of clock selected by the Post Office engineers is that known as the "Waiting Train," which is a specialty of Messrs. Gent and Company, Limited, of Leicester and London (Eng.).

The new clock is fixed on the bridge which connects the new portions of the General Post Office buildings to the old. It is bolted on to the face of the bridge, the dial being five feet in diameter. Instead of the ordinary Roman characters, the clock is provided with twelve distinguishing marks as advocated by the late Lord Grimthorpe. It is arranged for internal illumination, which is provided by electric lamps within a reflector which is disposed behind the dial and is the full diameter of it.

The small amount of current required for operating the "Waiting Train" movement is taken from the accumulator in the building, which has been installed for general purposes. The mechanism is under the constant control of a master clock, the control being effected by half-minute impulses in such a simple way that contacts or additional batteries are dispensed with.

A clear reading of the dial can be obtained under all conditions: the absence of a covering glass eliminates sun glare and reflection, which otherwise might cause difficulty in reading the time at some parts of the day. The great power held in reserve by the "Waiting Train" movement renders a covering glass unnecessary. The power produced by the mechanism is in direct proportion to the load put upon it, so that the hands cannot be stopped by snow or the most severe gales. The largest electric clock in the world —that on the Royal Liver Building at Liverpool—has had to face many gales of sleet and snow in its lifetime, being exposed to the powerful weather influences that sweep up the estuary of the Mersey. Thanks to the efficiency of the "Waiting Train" movement by which it is driven, it has kept time with unfailing accuracy since it was started on Coronation Day, 1911; the heaviest gales have had no effect upon its time-keeping qualities, despite the extraordinary length and weight of the hands.

We have received an interesting booklet dealing with the comparative weights of concrete and reinforcing metal required in different types of building construction. Besides dealing with the properties of plain concrete and giving a number of tables relating to the bending moments of concrete floors, the book contains some interesting graphical charts which facilitate the selection of the proper slab depth and steel reinforcement for various spans and loadings of reinforced concrete floors. These tables show the comparative wire sizes and mesh or weave of reinforcement required. Concrete pipe reinforcement is also dealt with, following the tables. The book is issued by the Canada Wire and Iron Goods Company, Hamilton.

Bulletin No. 221 of the Link Belt Company, Chicago, is descriptive of the firm's patent Circular Storage System for large bodies of material such as coal, gravel and stone. This system has earned the reputation of being the most economical method of reclaiming large bodies of loose materials. It consists of a long-radium locomotive crane, equipped with and operating a self-filling grab bucket, travelling on curved tracks around a central point from where the bucket receives its coal. Its advantages are enumerated as follows: low investment, low operating cost, low insurance charge, flexibility, and dependability.

Trade Inquiries

The Weekly Report of the Department of Trade and Commerce contains the following inquiries relating to Canadian trade. The names and addresses of the firms making these inquiries can be obtained by those specially interested in the respective commodities upon application to the Inquiries Branch, Department of Trade and Commerce, Ottawa:

668. **Steel.**—A South Staffordshire firm inquires for manufacturers of steel sections, sheets, plates and mild steel wire suitable for electrically welding. Specifications on file at the Department of Trade and Commerce, Ottawa (A-549).

674. **Earthenware sewer pipes.**—A Newfoundland manufacturers' agent is open to receive quotations from Canadian manufacturers of sewer pipes.

716. **Wrought iron and steel tubes and fittings.**—A Middlesbrough correspondent has a demand for wrought iron and steel tubes and fittings, and would like to get into touch with Canadian manufacturers able to supply.

717. **Steel sheets.**—A Birmingham firm dealing in military equipment is interested in the supply of steel sheets, nickeled, coppered and brassed, and would like to get into touch with Canadian manufacturers.

718. **Steel boiler tubes.**—A London engineer asks for names of Canadian manufacturers of locomotive steel boiler tubes, solid drawn or lap-welded.

719. **Railway wheels and axles.**—A London firm of engineers is in the market for railway wheels and axles, and would like to get into touch with Canadian manufacturers.

720. **Sheet zinc.**—A London firm of zinc and copper roofing contractors desires to get into touch with Canadian manufacturers of sheet zinc.

721. **Cement.**—A Newfoundland merchant asks to be put in touch with cement manufacturers in New Brunswick or Nova Scotia, the latter preferred owing to proximity.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Beauceville, Que.
A report has been submitted to the Town Council by J. Mignault, Engineer, Sherbrooke, Que., estimating the cost of the installation of waterworks, drainage, and lighting systems at $84,000. Clerk, F. Fortin.

Bertie Township, Ont.
Tenders will be received until June 11th by M. S. Pound, Ridgeway, Clerk to Township Council, for the construction of about 400 ft. of covered concrete drain, and about 4,750 ft. of open drain. Plans and specifications at office of Clerk.

Chatham, Ont.
The City Engineer will construct about 16,000 square feet of concrete sidewalk by day labor.

Guelph, Ont.
Work is about to start on the laying of macadam paving on various streets. Work to be done by day labor under supervision of City Engineer E. J. Holland, at a cost of 75c. per square yard. Approximate total cost, $6,000.

London, Ont.
It is proposed to construct a sewerage system at Lorne Heights, at an estimated cost of $72,000. City Clerk, S. Baker.

Montreal, Que.
Tenders will be received until June 12th by L. N. Senecal, Secretary to Board of Commissioners, for the following work in connection with the filtration plant:—(1) construction of an exterior electrical system; (2) additional earthwork; (3) additional concrete work; (4) additional conduit work. Plans and specifications with the Board. Approximate cost, $159,500.

Toronto, Ont.
A report prepared by the Government Engineer estimates the cost of the improvement of Kingston Road from Toronto to Oshawa at $128,000. Work to include grading and construction of ditches, tile drains, bridges and culverts.

The Board of Control will receive tenders until June 22nd for the construction of a sewer on Weston Road. Commissioner of Works, R. C. Harris, City Hall.

Trenton, Ont.
Work has been started on the construction of pipe sewers on various streets by day labor. Engineer, C. I. Halday. Estimated cost, $10,000.

Tuckersmith Township, Ont.
Tenders for the construction of Tyndall Drain will be received until June 12th by Township Clerk D. F. McGregor, Seaforth. Plans and specifications with Clerk.

Welland, Ont.
A by-law has been passed authorizing the construction of sewers on Sophia and Fell Streets. City Engineer, D. G. Black.

CONTRACTS AWARDED

Beauceville, Que.
The general contract for the construction of concrete sidewalks in the west part of the town has been let to Joseph Doyon, at 55c. per foot.

Belleville, Ont.
The City Council have let contracts for the construction of sewers to Manley & Patterson, $10,230, to Bumbaca & Wilde, $13,740, and to W. Donahue, $5,155.

New Westminster, B.C.
A contract for the construction of bitulithic paving on Twelfth and Columbia Streets has been let by the City Council to Columbia Bitulithic Company, Cambie Street, Vancouver, at $13,668.

St. Lambert, Que.
The Town Council have awarded the contract for the construction of about 5,600 lineal feet of concrete sidewalk and curb and the same amount of quadruple vitrified conduit beneath the sidewalk to Albini Lacroix, 35 Stanley Street.

St. Vital, Man.
The Municipality have let a contract for the construction of about 25,000 square yards of pavement to Charles Stewart & Company, Contractors, St. Vital, at $43,000.

Railroads, Bridges and Wharves

Eburne, B.C.
Material is being assembled for the construction of a wharf here by the Department of Public Works, Ottawa. Estimated cost, $5,000.

Fredericton, N.B.
The erection of a new superstructure on bridge over St. John River is being considered by the Intercolonial Railway. General Manager, F. P. Gutelius, Moncton, N.B.

Levis, Que.
The Municipal Engineer, Camille Lessard, has recommended that repairs be made to Ferry's Wharf immediately. Approximate cost, $10,000.

Nanaimo, B.C.
Plans of a subway to be built on Comox Road have been approved by the City Council. Work to include the lowering of a quantity of sewers and watermains. Estimated cost, $21,000. Clerk, S. Gough.

Quebec, Que.
The Department of Public Works, Ottawa, contemplate improving the St. Lawrence dock frontage of the Transcontinental Railway, at an estimated cost of $500,000. Secretary, R. C. Desrochers, Ottawa.

Toronto, Ont.
The Board of Control will receive tenders until June 15th for (a) concrete, masonry, substructure and concrete floor for bridge over C. P. R. tracks, and (b) supply and erection of steel superstructure. Plans at Room 311, Works Department, City Hall.

CONTRACTS AWARDED

New Westminster, B.C.
The general contract for the construction of the Fraser River jetty has been let by the Department of Public Works, Ottawa, to Marsh, Hutton Powers Company, Limited Western Trust Block. Estimated cost, $400,000.

St. Zehyrin, Que.
The contract for the erection of a steel and concrete bridge over St. Zehyrin River has been let by the Municipality to La Cie Construction de Nicolet, Nicolet, Que. Approximate cost, $3,000.

Public Buildings, Churches and Schools

Aneroid, Sask.
Plans have been drawn by Storey & Van Egmond, McCallum Hill Building, Regina, for a school to be erected for Consolidated School District. Estimated cost, $11,000.

The Trustees of School District No. 2704 have been empowered to borrow $13,000 for the erection and equipment of a school.

Chicoutimi, Que.
Work has been started by day labor on the construction of a public hall for La Corporation Episcopal de Chicoutimi. Architect, A. Lamontagne. Estimated cost, $8,000.

Ethel, Ont.
The congregation of the Methodist Church are considering the erection of sheds at an estimated cost of $3,500. Chairman of Committee, George W. Addy. Concrete block construction.

Graton, Sask.
The Provincial Government have authorized the Trustees of School District No. 13 to borrow $10,000 for completing the school. Treasurer, Frank M. Smith, St. Mary's School, Regina.

Gravelbourg, Sask.
The Trustees of School District No. 2244 have been authorized to borrow $5,200 for the purchase, remodelling and furnishing of a school building. Treasurer, A. Gravel, Gravelbourg.

L'Ange Gardien, Que.
The erection of an agricultural school is being considered by the Provincial Department of Public Works. Minister, J. E. Caron, Quebec.

London, Ont.
Tenders will be received until noon, June 10th, for the erection of a school on Princess Avenue for the Board of Edu-

cation. Plans and specifications at offices of the Architects, McBride & Gilbert, 402½ Richmond Street, and of the Associate Architect, A. E. Nutter, Room 15, Dominion Bank Chambers.

North Weyburn, Sask.
The Provincial Government have empowered the Trustees of School District No. 654 to borrow $3,500 for the erection and furnishing of a school. Treasurer, S. W. Gray, Box 565, Weyburn.

Orillia, Ont.
The Orillia Collegiate Institute Board contemplate the installation of heating and ventilating systems in the Institute. Secretary, T. W. Robbins.

Outlook, Sask.
H. O. Gronlid, c/o C. J. Rollefson, Franklin Avenue, will receive tenders until June 19th for the erection of a college for the Norwegian Lutheran College Association, and separate tenders on heating and plumbing. Plans and specifications at Y. M. C. A. buildings at Regina and Moose Jaw, and with Mr. Gronlid.

Rapid City, Man.
Tenders on the erection of a school for the Tremaine School District will be received until June 12th. Plans and specifications with Secretary, W. K. McKenzie, Box 79, Rapid City.

Renfrew, Ont.
The Library Board are applying to the Carnegie Library Trust for funds for the erection of a library building. Approximate cost, $15,000. Secretary, A. W. Baird.

Richmond, Que.
Tenders on the erection of a tower for the Anglican Church will be received until June 14th. Architect, H. G. James, Whiting Block, Sherbrooke, Que.

Sioux Lookout, Ont.
Tenders will be received until June 12th by A. Posnett, Secretary to School Board, for the erection of a four-roomed brick veneered school. Plans and specifications at offices of W. Hood, Architect, 19 Ruttan Building, Port Arthur, and of the Secretary. Estimated cost, $20,000.

South Antler, Man.
Tenders for the erection of a one-roomed school will be received until June 12th by Mark Wren, Cameron, Man., Secretary to School District No. 351. Plans and specifications at office of Secretary.

Swift Current, Sask.
Equipment will be required shortly for two schools being built for the City Council. Architects, Reilly, Dawson, Hancock & Reilly, 512 Western Chambers, Regina.

Toronto, Ont.
The Board of Education will receive tenders until June 11th for the following work:—brick play sheds at Winchester Street School; drain work at Annette Street School; cabinet work at Williamson Road School; sundry school repairs. Plans at office of Superintendent of Superintendent of Buildings, City Hall.

Tenders on the erection of an addition to Rosedale School will be received until June 11th by the Board of Education. Plans at office of Superintendent of Buildings.

Tenders will be received until 4 p.m., June 21st, by the Department of Public Works, Ottawa, for the supply and installation of interior fittings for Postal Station G. Plans and specifications with T. A. Hastings, Clerk of Works, Postal Station F, Toronto, and with the Department. Secretary, R. C. Desrochers.

CONTRACTS AWARDED

Berlin, Ont.
The Separate School Board have let the general contract for the erection of an addition to the Strange Street School to Casper Braun, Berlin. Brick construction. Approximate cost, $15,000.

Brantford Township, Ont.
The general contract for the erection of a school for School Section No. 6 has been awarded to Ingleby, Taylor & Company, Limited, 116 Brant Street, Brantford.

Brome, Que.
The general contract for the erection of a school on Mechanics Avenue for the Roman Catholic School Commissioners has been awarded to Bone & Chanon, Granby, Que. Brick construction.

L'Ange-Gardien, Que.
The contract for the erection of an annex to the school and for repairs has been let to Samuel Lefebre, Montmorency East, Que., at $6,000. Brick and frame construction.

Montreal, Que.
The contract for ornamental ironwork in connection with the orphanage being erected on Decary Boulevard has been let to Union Architectural Iron Works, 282 St. Catherine Street W.

In connection with the school being built on Madison Avenue for the School Commissioners of Coteau St. Pierre, the contract for steel work has been let to Structural Steel Company, Limited, 10 Cathcart Street.

Work has been started on the erection of an Anglican Church in the Ahuntsic Ward by Grovalet & Lefebvre, Papineau Avenue. Heating and plumbing will be sub-let.

New Glasgow, N.S.
In connection with the remodelling of the town offices, the contract for carpentry has been awarded to W. M. Fraser, Abercrombie Street, and for plumbing to Joseph Stewart, George Street.

New Waterford, N.S.
The general contract for the erection of a three-room addition to the school at Mount Carmel has been awarded by the School Board to D. J. McIsaac, Glace Bay, N.S. Approximate cost, $4,000.

Niagara Falls, Ont.
The contract for plastering in connection with the addition to the school on Kitchener Street has been let by the School Board to R. Smith & Sons, River Road.

Oil Springs, Ont.
The general contract for the erection of a church for the Roman Cathoilc Congregation has been awarded to F. Thorpe, c/o the Pastor, Father Campeau. White brick veneer construction, stone and concrete foundation, shingle roofing. Estimated cost, $7,000.

Ottawa, Ont.
In connection with the erection of St. Lucas Evangelist Church, McKay Street, the contract for electrical work has been awarded to W. R. McCallum, Bank Street.

Prelate, Sask.
The Trustees of School District No 3397 have let the contract for the construction of a frame school to J. Simpson, c/o C. H. Hoskyn, Secretary to th Trustees. Approximate cost, $3,000.

Quebec, Que.
The Sisters of St. Joseph de St. Valier, 70 St. Foy Road, have let the general contract and carpentry contract for the erection of a chapel to E. Rochette, 71 Des Stigmates Street. Brick construction, concrete foundation, metal roofing Approximate cost, $10,000.

Ramsayville, Ont.
The general contract, masonry, carpentry, plastering, painting, and heating contracts in connection with the erection of a church for the Presbyterian Congregation have been let to Cuthbertson & Clark, Hawthorne Avenue, Ottawa, and the contract for leaded glass to Colonial Art Glass Company, 840 Bank Street, Ottawa.

Yarmouth, N.S.
The general contract for the erection of a hall at Prince and Albert Streets for the Syrian Protective Association has been awarded to W. E. Simms. Work has been started.

Business Buildings and Industrial Plants

Colborne, Ont.
J. Reive contemplates the erection of an implement building. Frame and metal construction.

The construction of a curling rink is being considered by the Colborne Curling Club. Secretary, W. W. McGlennon

Fredericton, N.B.
The erection of a roundhouse on the U. N. B. athletic field is contemplated by the Intercolonial Railway. General Manager, F. P. Gutelius, Moncton, N.B.

Hill's Green, Ont.
Hugh Love, Seaforth P.O., has prepared plans for farm buildings, estimated to cost $3,000. Frame construction.

Hull, Que.
H. Dupuis & Son have commenced the construction of buildings in their lumber yards, recently destroyed by fire. Frame construction.

Kingsville, Ont.
Work has been started on the erection of a business block by B. Jasperson, Division Street. Brick construction. Estimated cost, $12,000.

Leamington, Ont.
The erection of a garage here is contemplated by R. J. Forster, White brick construction.

Medicine Hat, Alta.
The Lake of the Woods Mililng Company, Keewatin, Ont., contemplate the installation of a sprinkler system in their factory. Local Manager, W. W. McNeely.

Moncton, N.B.
The Acadia Sugar Refinery Company are considering the re-erection of their cooperage, recently damaged by fire. Work by day labor.

Montreal, Que.

Work has been started on the erection of a store and flats on St. Denis Street by F. Lamy, 507 LaSalle Road, Verdun. Approximate cost, $5,000.

J. Slack, 4824 Western Avenue, has commenced the erection of an office and residence at 67 McCord Street. Brick construction. Estimated cost, $7,000.

Orangeville, Ont.

John McKim will rebuild the business block recently destroyed by fire, with a loss of $15,000.

Ottawa, Ont.

The erection of a warehouse on Rideau Street is being considered by O. Petegorsky, 20 Stewart Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $5,000.

Prince Rupert, B.C.

Work is about to start on the erection of a moving picture theatre at Third Avenue and Fifth Street for Frank Hart. Approximate cost, $10,000.

Rock Island, Que.

All work in connection with the erection of a business block for S. J. Fregeau will be done by the general contractor, F. X. Lefebvre, Art Building, Sherbrooke. Approximate cost, $18,000.

Sherbrooke, Que.

The Canadian Box Mills are negotiating with the Town Council with regard to the erection of a box mill, estimated to cost $15,000. Town Clerk, E. C. Gatien.

St. Boniface, Man.

Raisig & Company are contemplating the erection of an abattoir, at an estimated cost of $5,000. Frame construction, metal siding, corrugated iron roofing.

St. John, N.B.

C. H. Peters & Sons, Limited, Peters Wharf, are about to rebuild their warehouse, recently destroyed by fire. Work by day labor.

Tavistock, Ont.

Work is progressing on the erection of stores and a garage for A. Wettleaufer.

Toronto, Ont.

Work has been started on the erection of a garage by J. O. Lodge, 312 Ossington Avenue. Brick construction, felt and gravel roofing. Estimated cost, $3,000.

W. J. S. Tremaine, 171 Keele Street, is receiving prices on heating and plumbing required in the erection of seven stores and apartments on Roncesvalles Avenue.

Work has been started on the erection of a store and apartments at 1655 Dufferin Street by Tudhope-Aletter, Limited, 1109 C. P. R. Building. Brick construction, tar and gravel roofing. Estimated cost, $6,000.

McConvey & Hughes, 18 Toronto Street, have commenced the erection of three stores and residences at Dufferin and McKay Streets. Brick construction, felt and gravel roofing.

Winnipeg, Man.

Plans have been submitted to the Board of Control for an addition to the office on King Street, and tenders will be called when plans are approved. Secretary, M. Peterson. Approximate cost, $20,000.

Yarmouth, N.S.

J. F. Ehrgott is building a garage at Main and Porter Streets. Reinforced concrete construction.

CONTRACTS AWARDED

Berlin, Ont.

In connection with the fruit warehouse being built for Longo Bros., 114 King Street E., the contract for masonry and plastering has been awarded to Wunder Bros., 20 Peter Street, and for carpentry and steel work to H. Dunker & Son, 46 Shanley Street. Other trades not let.

Brantford, Ont.

Work has been started on extensions to a machine shop for the Ker & Goodwin Machine Company, Limited, 256 Colborne Street, by P. H. Secord & Sons, Limited, 133 Nelson Street. Sand lime and red pressed brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

Chatham, Ont.

The general contract for rebuilding the brass plant of the Canadian Wolverine Brass Company, St. Clair Street, has been let to B. Blonde, 14 Cornhill Street. A contract for a further addition will be let later.

Cottam, Ont.

F. S. Birch & Son, have commenced the erection of frame farm buildings for Amon Noble.

Essex, Ont.

E. McHugh has let the contract for the erection of a garage to David Croft, and work has been commenced. Concrete block construction, felt and gravel roofing. Estimated cost, $4,000.

Guelph, Ont.

The following contracts have been let in connection with the store being built on Quebec Street for Benson Bros., Wyndham Street:—carpentry, G. Scroggie, Edwin Street; steel, Standard Steel Construction Company, White Block, Welland; roofing, H. Occomore & Company, Upper Wyndham Street; plastering, Peter Martin; heating, Fred Smith, Quebec Street; plumbing, Mahoney Bros., Quebec Street; electrical work, Stevenson & Malcolm Company, Upper Wyndham Street.

Hamilton, Ont.

Takefman & Goldblatt, 73 Robert Street, have let the general contract, masonry, carpentry, and steel contracts for the erection of a warehouse to M. Levy, 215 Park Street N. Estimated cost, $5,000.

London, Ont.

The International Harvester Company, York Street, have let the contract for the erection of a frame storage building to R. G. Wilson, 5 St. George Street. Estimated cost, $4,500.

The general contract for the erection of four stores on Dundas Street for P. B. Fetterley and M. Aylesworth, Huron and Erie Streets, has been awarded to John Moran, 937 Maitland Street. Smaller trades will be sub-let. Approximate cost, $10,000.

Montreal, Que.

In connection with the erection of a still and boiler house and condenser house for the Canadian Tar Products Company, Limited, the contract for concrete foundation has been let to A. E Byers & Company, Limited, 340 University Street.

In connection with the warehouse and office being built at 167 McCord Street by M. J. Stack, 4824 Western Avenue, the roofing contract has been awarded to Standard Roofing Company, 189 McCord Street, and the contract for plumbing to T. O'Connell, 183 Ottawa Street. All other work by day labor.

Ottawa, Ont.

The general contract for an addition to a garage at McLaren & Cartier Streets has been let to T. C. James, 140 Flora Street, and the carpentry contract to W. G. Adamson, 126 Sparks Street. Brick construction. Architects, Horwood, Taylor & Horwood, 130 Sparks Street.

The masonry contract in connection with the erection of stores on Gladstone Street for Donald Fraser, 82 O'Connor Street, has been awarded to R. J. Watson, 186 Hawthorne Street, the carpentry contract to John Tompson, 109½ Wellington Street, and the plastering contract to L. Lafontaine, 227 McKay Street.

The general contract for the erection of an addition to a store on Elgin Street for S. W. Halliday, 20 Arlington Street, has been awarded to A. C. Burton, McLeod Street. Brick construction, felt and gravel roofing. Approximate cost, $8,000.

The following contracts have been let in connection with alterations to a store on Sparks Street for Stewart, Dewer & Rosenhall, Sparks Street:—general contract, Shuttleworth & Black, 21 Euclid Street; steel work, Canadian Agency & Supply Company, Booth Building; painting, W. G. Carson, 293 Laurier Street W. Electrical work by day labor, under supervision of general contractor.

In connection with the theatre being erected on Queen Street for B. Stapleton, Queen Apartments, the contract for tinsmithing and roofing has been let to McFarlane & Douglas, 250 Slater Street, and the plastering contract to L. H. Kalakov, 107 Friel Street.

Port Hope, Ont.

In connection with the erection of a storehouse on Walton Street for J. Curtis & Son, the brickwork contract has been let to Thomas Garnett & Sons, and the carpentry contract to W. R. Chislett, Cavan Street.

Preston, Ont.

The masonry contract in connection with the erection of stores and offices for Wendel & Shantz, King Street E., Berlin, has been awarded to Wirsching Bros., Duke Street, the carpentry contract to H. Nipel, Waterloo Street, and the contract for the supply of lumber to W. Kribs, Guelph Street.

Quebec, Que.

Work has been started on repairs to a store for B. Leonard, 53 St. John Street. The carpentry contract has been let to L. H. Peters, Limited, 10 St. Angele Street. Estimated cost, $7,000.

In connection with the store being erected for the Paquet Company, Limited, St. Joseph Street, the roofing contract has been let to E. Falardeau, 143 Dorchester Street. Heating, plumbing and electrical work to be done by day labor.

Regina, Sask.

In connection with the erection of a bowling alley for Nay & James, 1836 Hamilton Street, the general contract has been awarded to T. Barnard, 211 Westman Chambers, the contract for mill work to Hastings & Willoughby, 1719 Cornwall Street, and the heating and plumbing contract to Potts & Smith, 1811 Cornwall Street. Painting contract not let.

Riviere du Loup, Que.
In connection with the store being erected for A. E. Thivierge, the contract for masonry work and carpentry has been awarded to J. Charest, and the painting contract to A. Desjardins. Roofing, heating, plumbing and electrical work not let. Approximate cost, $10,000.

St. Anne de la Perade, Que.
The contract for the erection of a drug store and cottage for Dr. Bouille has been awarded to Henry Godin. Approximate cost, $5,000.

Stratford, Ont.
J. P. Chiswell, 32 Downie Street, has let the contract for the erection of an addition to his store to Everett & Marson.

Sydney, N.S.
J. F. Miles, 251 Charlotte Street, has awarded the contract for repairs to his store to S. H. Stevenson, 90 Charlotte Street. Approximate cost, $15,000.

Tara, Ont.
The general contract for the erection of a business block for A. Wain has been awarded to W. P. Evans, 654 Eighth Street E., Owen Sound. Approximate cost, $5,000.

Toronto, Ont.
In connection with the factory being built on Carlaw Avenue for W. Wrigley, Jr., Company, Limited, 7 Scott Street, the contract for painting has been let to Cohen & Son, 32 Carlaw Avenue. Approximate cost of building, $200,000.

Victoria, B.C.
The general contract for the erection of a store and bank building at Fort and Government Streets has been let by Mrs. C. G. Meldram, 422 Simcoe Street, to Luney Bros., 508 Sayward Building. Approximate cost, $8,000.

Windsor, N.S.
The general contract for the erection of a store for W. E. Regan has been let to James H. Brown. Brick construction.

Winnipeg, Man.
The terra-cotta for the store and office building being erected on Portage Avenue for D. S. Curry, c/o Oldfield, Kirby & Gardner, 234 Portage Avenue, is being supplied by North Western Terra Cotta Company, c/o W. T. Grose, 905 Electric Railway Chambers.

The general contract for the erection of warehouse at Chambers and Henry Streets for the Cream of Wheat Company, Minneapolis, Minn., has been awarded to T. Sharpe, Kennedy and Qu'Appelle Streets. Arrangements have been made for all smaller trades. Estimated cost, $20,000.

Residences

Auburn, N.S.
Plans for a bungalow have been prepared by C. H. McClare, 649 Massachusetts Avenue, Cambridge, Mass., for Wesley Jacques. Estimated cost, $3,500.

Charlottetown, P.E.I.
A residence will be built on Brighton Street for W. H. Tidmarsh by day labor. Frame construction. Estimated cost, $6,000.

Chedoke, Ont.
Charles Blewey is building a frame residence, estimated to cost $3,000. Foundations are in.

Formosa, Ont.
George Seitz will rebuild his residence, which was recently destroyed by fire. Estimated cost, $3,000. Architect not chosen.

Galt, Ont.
Tenders will be received until June 4th by J. Evans, Architect, 30 Water Street N., for the erection of a residence for J. R. Blake, Gilholm Avenue. Brick construction. Approximate cost, $6,000.

Guelph, Ont.
Tenders will be received until June 5th by W. A. Mahoney, Architect, Telephone Building, for the erection of a residence for Miss M. E. Murdoch. Brick construction, stone and concrete foundation, shingle roofing. Estimated cost, $4,500.

Hamilton, Ont.
A residence is being built on St. Clair Avenue by Thomas Hawkins, 60 Barnsdale Avenue. Smaller trades will be let shortly. Approximate cost, $4,000.

T. R. Huxtable, 208 Holton Avenue S., will start work shortly on the erection of two residences on St. Clair Ave., estimated to cost $4,000 each. Brick construction, stone foundation, shingle roofing.

In connection with a residence being erected on St. Clair Avenue by T. R. Huxtable, 208 Holton Avenue S., contracts will be let shortly for plastering, painting, heating and plumbing.

Seymour & Walker, Bank of Hamilton Building, are about to erect two residences on Beulah Avenue, at a cost of about $2,500 each. Smaller trades will be let. Brick construction, stone foundation, shingle roofing.

Plans of a bungalow to be erected on Hillcrest Avenue for H. C. Gemmell are being prepared by W. B. Brown, Clyde Block. Stucco and brick construction. Estimated cost, $3,500.

Hamiota, Man.
Tenders on the smaller trades required in the erection of a farm residence are being received by Arthur Atkinson, c/o R. L. Smith, Architect, 301 Boyd Building, Winnipeg. Estimated cost, $9,500.

Honeydale, N.B.
G. F. Beach will rebuild his residence and barns, which were recently destroyed by fire. Approximate cost, $4,200.

McKillop Township, Ont.
The erection of a residence is contemplated by Henry Dennis, Seaforth P. O. Frame and white brick construction. Estimated cost $3,000.

Middlemiss, Ont.
William Carroll, Pleasant Valley, Middlemiss, contemplates the erection of a residence estimated to cost $3,000. Frame and white brick construction.

Middleton, N. S.
A. J. Morrison contemplates the installation of a steam heating system in his residence.

Mount Dennis, Ont.
Plans have been prepared for a residence to be erected on Buttonwood St. by Boskerville Building Company. Brick construction, concrete foundation, shingle roofing. Estimated cost, $4,500.

Mount Hamilton, Ont.
Plans are being drawn for three residences to be built by S. Burkholder, East 22nd Street. Brick construction. Approximate cost, $3,500 each.

Work has been started on the erection of a residence by S. Burkholder, East 22nd Street. Brick construction, concrete foundation, shingle roofing. Estimated cost, $3,500.

Oakville, Ont.
Tenders for the erection of a brick veneer residence will be received by Daniel McDermott. Estimated cost $4,000.

Work is about to start by day labor on the erection of a residence, under the supervision of W. A. Deane. Brick construction.

Ottawa, Ont.
Work has been started on the erection of a residence on Irving Street by W. C. Leech, 140 Spadina Street. Plastering, heating, plumbing and electric wiring will be let. Approximate cost, $4,000.

E. W. Foster, 80 Spadina Street, contemplates the erection of a residence on Carruthers Street. Brick veneer construction, concrete foundation, shingle, felt and gravel roofing. Estimated cost, $4,500.

B. A. Grison, Fentiman Avenue, is considering the erection of several residences, to cost about $4,000 each. Concrete block construction.

The erection of a residence on Electric Street is contemplated by Phillippe Diapeant, 145 George Street. Brick veneer construction, concrete foundation, felt and gravel roofing. Approximate cost, $3,000.

T. J. Somerville, 29 Broadway Avenue, contemplates the erection of a residence on Frank Street, estimated to cost $5,500. Double brick veneer construction, stone foundation, shingle roofing.

Work has been started on the erection of a residence on Sherbrooke Street by G. Cadeau, 393 Bank Street. Brick veneer construction. Approximate cost, $3,800.

Prices are being received by A. E. Shaver, 45 Powell Avenue, on the plumbing, heating and electrical work required in connection with the residence being erected on Findlay Street. Estimated cost, $4,000.

Work has been started by W. H. Lee, Billings Bridge, on the erection of a residence on Fentiman Street. Brick veneer and stucco construction, stone foundation, shingle roofing. Approximate cost, $3,800.

Quebec, Que.
F. X. Lachance, 109 Franklin Street, has commenced the erection of a residence. Brick and frame construction, concrete foundation, metal and asbestos roofing. Estimated cost $3,000.

J. Nadeau, 139 Notre Dame Des Anges Street, has commenced the construction of a brick and frame residence on Bourlamarque Street. Estimated cost, $6,000.

Tavistock, Ont.
William Horman contemplates the erection of a residence.

Tenders will be received until June 15th by John Zimmerman for the remodelling of the Methodist manse. Plans and specifications with Mr. Zimmerman.

Toronto, Ont.

Work has been started on the erection of a residence on Wightman Avenue by Playter & Chapman, 176 Danforth Avenue. Tenders have been received for all trades required. Approximate cost, $5,000.

S. B. Green, 650 Annette Street, is erecting four residences on Conduit St., estimated to cost $12,000. Smaller trades will be let. Brick construction, shingle roofing.

A brick residence is being erected by F. W. Warren, 105 Wells Hill Avenue. Approximate cost, $4,500.

A residence is being erected by W. J. Nixon, 32 Columbine Avenue, at an estimated cost of $4,000. Brick construction, shingle roofing.

Work will be started shortly on the erection of a residence on Columbine Avenue by Forde & McCurrah, 125 Rainsford Road. Brick construction, shingle roofing. Estimated cost, $4,000.

Caplan Bros. & Layevsky, 237 Augusta Avenue, are building three pairs of residences on Leonard Avenue. Brick construction, shingle, felt and gravel roofing. Approximate cost, $10,500.

The erection of three residences on Bellevue Place has been commenced by Caplan Bros. & Layevsky, 237 Augusta Avenue. Brick construction, shingle, felt and gravel roofing. Approximate cost, $4,500.

Walkerton, Ont.

A residence is being built by W. Miehlhausen, Shaw's Hill, Walkerton. Red brick construction. Estimated cost, $3,500.

Westboro, Ont.

The erection of two brick veneer residences on Golden Avenue is being considered by R. E. Ralphs. Work by day labor. Estimated cost, $3,000 each.

CONTRACTS AWARDED

Ancaster, Ont.

The masonry contract in connection with additions and alterations to the residence of John McNevin has been let to J. N. Middleton. Pressed brick construction, stone foundation. Approximate cost, $5,000.

Annapolis Royal, N.S.

The general contract for the erection of a residence has been let by Claude King to J. J. McMurty, Margaritville, N.S. The report published in our issue of April 21st is in error.

Avonton, Ont.

The general contract for the erection of a residence has been let by J. Atcheson, Sebringville P. O., to Allison & Moore, Stratford. Brick and frame construction. Estimated cost, $3,200.

Belleville, Ont.

H. S. Parry is building a residence on Ann Street for H. W. Ackerman, 55 Queen Street. Brick construction. Estimated cost, $6,000.

Chatham, N.B.

Material for the frame residence being built for Henry Morris is being supplied by W. & R. Walsh, Wellington St.

Work has been started on the construction of a frame residence for H. H. Carvell, Duke Street, by W. & R. Walsh, Wellington Street. Estimated cost, $5,000.

Guelph, Ont.

In connection with the residence being built on Sydenham Street for H. G. Cockburn, the masonry contract has been let to Johnston & Williams, Tiffany Street, the carpentry contract to H. W. Handbidge, 16 Suffolk Street, and the painting contract to Dennis & Bennett, 22 Suffolk Street.

A residence is being built on College Heights for Miss G. Boyle by Shepherd & Hicks, Paisley Street. Stone and brick construction. Approximate cost, $3,000.

Work has been started on the construction of a double residence for Miss L. Reinhardt by W. E. Taylor, Eramosa Road. Stone and brick construction. Approximate cost, $3,600.

Halifax, N.S.

R. P. Bell, 3 Prince Street, has awarded the contract for the erection of five residences on Bloomingdale Avenue to Nova Scotia Construction Company, 159 Upper Water Street. Frame construction, concrete foundation, shingle roofing. Approximate cost, $5,000 each.

Hamilton, Ont.

In connection with the erection of a residence at Wilson and Wentworth Streets, for G. W. Gordon, 361 Wilson Street, the masonry contract has been awarded to T. Launders, 65 Ontario Avenue, the carpentry contract to E. S. Woods, 18 Belleview Avenue, and the painting contract to R. J. Paul, 156 Sanford Avenue S. Other trades not let. Estimated cost, $5,500.

The heating contract in connection with the residence being built on Maple Avenue by W. E. McKim, 17 Greenaway Avenue, has been awarded to P. A. Moore, 939 King Street E. Other trades not let.

Work has been started on the erection of a residence on Sherman Avenue for J. W. Roderick, 104 Spadina Avenue. The general contract, masonry, carpentry and roofing contracts have been let to Isbister Bros. Other trades not let. Approximate cost, $3,500.

The general contract and masonry contract for alterations to a residence for W. M. Currie, Freeman Place, have been awarded to D. Tope, 187 Robinson St., and the carpentry and roofing contracts to G. Evans, care of general contractor. Other trades not let. Estimated cost, $3,000.

Ingersoll, Ont.

James Mabery has let the general contract, carpentry and roofing contracts in connection with the erection of a residence to R. Layton, and the contract for masonry and plastering to W. McKay. Other trades not let. Estimated cost, $3,000.

London, Ont.

Hyatt Bros., 288 Egerton Street, have commenced the erection of a residence for Charles Stevens, 298 Grosvenor St. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Work has been started on the erection of a residence on Hamilton Road for Dr. Copeland, Arkona P. O., by T. H. Robinson, Ealing P. O. Brick veneer construction, shingle roofing. Estimated cost, $3,000.

A residence is being erected at 811 Talbot Street for Mildred McLean, 519 Hyman Street, by S. Murray & M. J. Morrison, Dundas Street E. Smaller trades will be sub-let. Brick construction, concrete foundation, shingle roofing. Approximate cost, $4,500.

The contract for the erection of a residence for Miss Ingram, 202 Waterloo Street, has been awarded to W. Jeffery, 419 Simcoe Street. Red pressed brick construction, slate roofing. Estimated cost, $5,000.

Lorraine, Ont.

J. L. Crane has let the contract for the erecton of a frame summer cottage to Hanna Bros., Fort Erie, Ont. Approximate cost, $3,000.

Maisonneuve, Que.

In connection with the residence being erected by H. Bernier, 758 Adam Street, the contract for masonry and brickwork has been let to Desjardins & Gelinas, 162 Jean d'Arc Avenue, and the contract for roofing to W. Theriault, 283 William David Street. Other trades not yet let.

Melville, Sask.

The Spencer Land Company have awarded the general contract for the construction of a residence and barn to Charles Hart. Material will be furnished by owners.

Montreal, Que.

In connection with the residence being built on Vendome Avenue by C. Fyfe, Belmore Avenue, the contract for heating and plumbing has been awarded to J. B. Station, 5410 Sherbrooke Street, Westmount.

The sub-contract for roofing in connection with the residence being erected on Oxford Avenue for W. A. McQuestin, 46 St. Alexander Street, has been let to J. Dunphy, 55 Barrie Street, the plumbing contract to W. Williams, 251 Cote St. Luke Road, and the electrical contract to W. Eversfield, 20 Marcil Avenue.

The following contracts have been awarded in connection with the erection of two residences on Madison Avenue for F. C. Connolley, 774 St. Dominique Street:—roofing, J. Dunphy, 55 Barrie Street; plumbing, W. Williams, 251 Cote St. Luke Road; electrical work, W. Eversfield, 205 Marcil Avenue.

Newmarket, Ont.

John F. Smith, Yonge Street, has let the general contract for the erection of a brick residence to I. S. Rose, Niagara Street. Approximate cost, $3,000.

Niagara Falls, Ont.

In connection with the residence being built on Bamfield Street for Henry Marshall, Queen Street, the contract for heating and plumbing has been let to Charles Fletcher, Simcoe Street.

Oakville, Ont.

In connection with the erection of a residence on Dundas Street for James Blakelock, the general contract has been let to T. Blakelock, Church Street, the masonry contract to W. M. Wass, Dundas Street, the heating and plumbing contract to J. N. McGregor, Colborne Street, and the electrical contract to B. E. Sprowl. Carpentry work by day labor.

A. F. Ford has commenced the erec-

(Continued on page 53)

Tenders and For Sale Department

Tenders for Pavement

Sealed tenders, addressed to A. H. Millar, City Clerk, will be received up to 5 o'clock p.m., **June 18**, for the construction of approximately 2,000 sq. yds. of concrete pavement in the City of Berlin. Plans and specifications may be seen at the office of the City Engineer. The lowest or any tender will not necessarily be accepted.

HERBERT JOHNSTON,
City Engineer.

23-24

Mail Contract

Sealed tenders, addressed to the Postmaster General, will be received at Ottawa until noon, on **Friday, the 2nd of July, 1915**, for the conveyance of His Majesty's Mails, on a proposed Contract for four years, six times per week each way, Markham (via Box Grove and Cedar Grove) Rural Mail Route, from the Postmaster General's pleasure.

Printed notices containing further information as to conditions of proposed Contract may be seen and blank forms of Tender may be obtained at the Post Offices of Markham, Box Grove, Cedar Grove and at the office of the Post Office Inspector, Toronto.

A. SUTHERLAND,
Post Office Inspector.

Post Office Inspector's Office,
Toronto, May 19th, 1915.
52 A.—5M.-25-7-13 21-23

Department of Railways and Canals, Canada

Hudson Bay Railway Terminals

Port Nelson, Man.

Sealed tenders, endorsed "Tender for Hardware," will be received by the undersigned, up to 12 o'clock noon on **Thursday, June 10th, 1915**, for the furnishing of the above, to be delivered in such quantities at Halifax, N.S., and at such times as may be directed.

Dealers may tender for the total quantities required, or for such portions thereof, as may suit their convenience.

Specifications of requirements, and full information can be obtained from the Purchasing Agent of the Department of Railways and Canals, Ottawa, on and after this date.

An accepted bank cheque for $500, made payable to the order of the Minister of Railways and Canals must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for supplying any of the goods awarded to him, or in any way fails to properly fulfill the same.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The lowest or any tender not necessarily accepted.

By order,
J. W. PUGSLEY,
Secretary.

Department of Railways and Canals,
Ottawa, May 28th, 1915.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—80818. 23

TENDERS

The Village of Brussels in the County of Huron, Ontario, are asking for tenders for street paving and curbing of the Main Street. Plans and specifications can be seen at office of John Roger, Engineer, Mitchel, Ont., or at the Clerk's office. Tenders received up to June 15th, 1915.

F. S. SCOTT,
Village Clerk.

22-23

COUNTY OF HALDIMAND

Good Roads Committee

Tenders will be received for the construction of at least ten reinforced concrete highway bridges varying in span from 6 ft. to 32 ft., on or before the **14th of June, 1915**. Plans and specifications may be seen and forms of tender obtained at the office of the County Engineer, Dunnville, Ontario, any day after the 1st of June, 1915. Tenders to be addressed to

Mr. BAIN, Chairman,
Good Roads Committee,
20-23 R. R. No. 1, South Cayuga, Ont.

Tenders Wanted

Sealed tenders will be received up to and including **Monday, June 21st**, by the Secretary of the Board of Education, Brighton, Ont., in whole or in part, for the different trades required in the erection and completion of a Union School Building. Plans and specifications can be seen and all particulars obtained from the Department of Agriculture Offices, Brighton; also at the offices of the Architects. No tender necessarily accepted.

E. C. BROWNE,
Sec.-Treas., Board of Education,
Brighton, Ont.

Ellis & Ellis, Architects,
Manning Chambers, Toronto. 23-24

Hydro Electric Power Commission of Ontario

CITY OF STRATFORD

(Ontario, Canada)

Waterworks Elevated Water Tower

Notice to Contractors

Specifications for a 500,000 Imperial gallon elevated water tower will be issued on **Friday, June 4th**, and sealed tenders, mailed to the undersigned, and marked "Tender for Stratford Elevated Water Tower," will be accepted until 9 a.m. on **Friday, June 25, 1915**. Copies of the above specifications, and form of tender, can be obtained from the address given below.

The lowest or any tender will not necessarily be accepted.

F. A. GABY,
Chief Engineer,

Hydro-Electric Power Commission of Ontario,
Continental Life Building,
Toronto, Ontario.

This advertisement will not be paid for if inserted without authority from the Commission.

22-23

School Tenders

Tenders will be received at the office of W. Grayson-Brown, Architect, 204 Clyde Block, Hamilton, until **June 15, 1915**, for alterations and additions to the High School at Whitby, Ont.

Plans and specifications may be seen at the offices of the architect, R. N. Bassett, Whitby, Ont., and the Toronto Builders' Exchange. 23

Tenders for Concrete Abutments

Sealed tenders, plainly marked as to contents, will be received by Chas. Wattie, Esq., R. M. D. Anten Mills, Ont., up to 6 o'clock p.m. of **Monday, June 21st, 1915**, for the construction of concrete abutments for a steel bridge on the Minesing Road, Lot 9, Con. VIII., Twp. Vespra, in the County of Simcoe.

Plans and specifications may be seen at the residence of Mr. Wattie and at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Consulting Engineer.

Toronto, June 7, 1915. 23

Tenders for Concrete Abutments

Sealed tenders, plainly marked as to contents, will be received by Levi Taylor, Esq., Victoria Harbor, Ont., up to 6 o'clock p.m. of **Monday, June 21st, 1915**, for the construction of concrete abutments for a steel bridge on the townline between Matchedash and Tay Townships, Lot 3 Tay, over Bear Creek, County of Simcoe.

Plans and specifications may be seen at the residence of Mr. Taylor and at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Consulting Engineer.

Toronto, June 7, 1915 23

FOR SALE

A Bargain, Parsons Trenching Machine almost new. Digs to twenty feet deep and up to five feet wide. Box 196, Contract Record, Toronto.

21-23

FOR SALE

Second-hand Corliss engine, 200 h.p., complete in every detail. Excellent condition. For further particulars write, Material Department, The Goodyear Tire & Rubber Co. of Canada, Ltd.,

23 Bowmanville, Ont.

Business Opportunity

Will sell Canadian patent rights Baltzer System of constructing inexpensive concrete houses. Only successful system of kind. Most comfortable, durable, attractive, 5-room houses built. Simple apparatus. System has fully demonstrated its worth in the United States. Approved by Government. Write for details immediately.

AUGUST BALTZER,
Severance Building,
21-25 Los Angeles, Cal.

Residences

(Continued from page 51)

tion of a residence on Douglas Avenue, estimated to cost $7,000. Stone, hollow tile and pressed brick construction, shingle roofing. Owner, E. N. Kniller.

The general contract for the erection of a residence on Reynolds Street for Philip Chambers has been awarded to C. H. Marshall, the plastering contract to C. Beauchamp, the heating and plumbing contract to J. N. McGregor, Colborne Street, and the contract for electrical work to B. E. Sprowl. Carpentry work by day labor.

The general contract for the erection of a residence on Reynolds Street for J. Freestone has been let to W. J. Hawkes, the heating contract to J. N. McGregor, Colborne Street. Approximate cost, $4,000.

In connection with the erection of a residence for C. M. Buzzard, the contract for masonry has been let to Galley Bros., Allan Street, the plastering contract to C. Beauchamp, the heating contract to H. E. Moore, Colborne Street, the plumbing contract to W. Whitaker, Colborne Street, and the contract for electrical work to W. McDonald.

Ottawa, Ont.

The general contract for the erection of a residence for W. F. B. Martin, 145 Third Avenue, has been let to Jones & Anderson, care of Burgess & Millson, Architects, 133½ Sparks Street. Approximate cost, $6,000. Stone foundation, brick veneer construction, shingle roofing.

The heating and plumbing contract in connection with the residence being erected on Sunnyside Street for A. E. Toms, 125½ Bank Street, has been awarded to H. A. Knox, 346 Elgin St.

In connection with the residence being built on Adelaide Street by Frank Linton, 7 Centre Street, the contract for heating and plumbing has been let to J. P. Band & Company, 775 Bank Street, and for electrical work to P. Ackroyd, 416 Bank Street.

The contract for electrical work in connection with additions to apartments on Frank Street for F. Argue, 196 James Street, has been let to C. Presby, 138 Irving Street.

A residence will be built on Fifth Avenue by W. H. Craig, 136 Bank Street. Owner will sub-let plastering, painting, heating, plumbing and electrical work. Estimated cost, $5,000.

The contract for the erection of a residence on Woodlawn Street for E. G. Brown, Hope Chambers, has been awarded to Cuthbertson & Clark, 143 Hawthorne Street. Stucco and brick veneer construction, stone foundation, shingle roofing. Approximate cost, $5,500.

Outremont, Que.

In connection with the residence being erected at Wiseman and Marsolais Streets by Pierre Guidazio, the plastering contract has been let to E. Gaudette, 530 Alma Street, Montreal, the roofing, heating and plumbing contract to J. E. Blanchard & Son, 2168 St. Lawrence Boulevard, Montreal, and the contract for electrical work to G. Martel, 229 Bernard Street, Montreal

The following contracts have been let in connection with the two stores and residences being built on Lajoie Avenue by N. Matineau, 1231 Lajoie Avenue:—stone work and masonry, N. Beauchamp, 1559 Bordeaux Street, Montreal; roofing, heating and plumbing, J. E. Blanchard & Son, 2168 St. Lawrence Boulevard, Montreal; electrical work, J. J. Valois, 444 Durocher Street, Montreal.

Peterboro, Ont.

Work has been started on the erection of a residence on Hunter Street for J. J. Duffus, 195 Simcoe Street. The general contract, carpentry, roofing and heating contracts have been let to John Douglas and A. Davidson, and the plumbing and electrical contracts to F. R. J. MacPherson Company, Limited, 341 George Street. Other trades not let.

Quebec, Que.

Work has been started on the erection of a residence on Canardierre Road for L. Tremblay, 308 St. Joseph Street. The general contract and carpentry contract have been let to E. Bouchard, 185 Crown St. Brick and frame construction, felt and gravel roofing. Approximate cost, $4,000.

The general contract and carpentry contract for the erection of a residence on Moncton Street for P. Trudel, 43 d'Aguillon Street, have been awarded to P. A. Lamonde, 48 St. Francois Street. Brick and frame construction, concrete foundation, metal roofing. Approximate cost, $6,000.

Rivers, Man.

The general contract for the erection of a residence has been let by William Bailey to W. J. Higgin, 341 21st Street, Brandon. Estimated cost, $4,750.

Senneville, Que.

The plastering contract in connection with the residence being erected for R. R. Macauley has been awarded to F. A. Sims, 450 Madison Avenue, Montreal, and the electrical contract to E. A. Gregory, 159a Cadieux Street, Montreal.

South Woodslee, Ont.

The general contract for the erection of a residence for A. Noble, Concession 11, Woodslee, Essex P. O., has been let to F. S. Birch & Son, Cottam, Ont. Frame construction. Estimated cost, $3,200.

Toronto, Ont.

In connection with the duplex residence being built at 490 Summerhill Avenue by J. A. Moss, 78 Grenadier Rd., the plumbing and heating contract has been awarded to F. J. Nixon, 270 Euclid Avenue. Plastering, painting and electrical wiring not yet let.

The contract for electric wiring in connection with the residence being erected at 483 Summerhill Avenue by R. Doherty, 56 St. Andrew's Gardens, has been let to W. G. Pattilo, 40 Winchester Street, the heating and plumbing contract to H. Griffin, and the painting contract to J. Bennett, 72 Robert Street.

The following contracts have been let in connection with the residence being built on Standish Avenue by J. H. Shier, 74 Westmount Avenue:—plastering, H. Brooks, 316 Salem Avenue; painting, G. Powell, 228 Fairview Avenue; wiring, A. Eikenaar, 5 Bradd St.; roofing and sheet metal work, H. Smith, 506 Crawford Street; concrete work, Griffin Contracting Company, 7 McRoberts Street. Prices on hardwood flooring and hardware are being received by owner.

In connection with the residence being built at 78 Glencairn Street by G. T. Death, 244 Sheldrake Avenue, the contract for heating has been awarded to A. Crossley, 89 Dearbourne Avenue.

The general contract for the erection of a pair of residences at 329-331 Soudan Avenue, for J. W. L. Forster, 24 King Street West, has been let to Vickery & Page, 439 Balliol Street. Smaller trades will be sub-let. Brick construction, shingle, felt and gravel roofing. Estimated cost, $5,000.

A residence is being erected on Pine Avenue for F. J. Cummings by Cox & Cummings, 2118 Queen Street E. Brick construction, shingle roofing. Approximate cost, $5,000.

The general contract for the erection of a pair of residences at 143-145 Broadway Avenue, has been let by E. Grainger, 1360 Yonge Street, to E. Martin, 18 Keewatin Avenue. Smaller trades will be sub-let. Brick construction, shingle, felt and gravel roofing. Approximate cost, $4,000.

In connection with the residences being built on Bellefair Avenue by J. Thorn, 221 Woodbine Avenue, the electrical contract has been let to Dolson & Palmer, 275 Waverley Road, and the plastering contract to T. Wilay, 4 Elmer Avenue.

Work has been started on the erection of a residence on Glenholme Street by W. R. McGiffin Company, Limited, 1504 King Street West. Estimated cost, $5,000. Owner's name withheld.

Wolfville, N.S.

The contract for the construction of a farm residence has been awarded by J. Oscar Harris to Ernest Eagles.

Zurich, Ont.

In connection with the erection of a residence for Samuel Dietz, the general contract and masonry contract have been let to H. Howland, and the carpentry contract to F. C. Kalbfleisch. Estimated cost, $3,500.

Weber & Meyers are building a residence for F. Hess. Port Credit pressed brick construction. Approximate cost, $3,200.

The general contract for the erection of a residence for Louis Kraft has been let to H. Howard, and the carpentry contract to F. C. Kalbfleisch. Brick and frame construction. Estimated cost, $3,500.

Power Plants, Electricity and Telephones

Calgary, Alta.

The construction of a series of six dams and power houses is being considered by the Alberta Hydro-Electric Power Company, Limited, Calgary. Consulting Engineer, A. W. Ellson Fawkes, 518 Burns Building. Approximate cost, $2,000,000.

Saskatchewan Province.

The following Rural Telephone Companies have been empowered to borrow money:—Starr's Point, $1,200; Lone Corner, $3,500; Walpole, $2,000; Scandinavian, $4,000; Loch Ayr, $5,800; Idylwylde, $500; Orange View, $4,200; Good Hope, $5,200; Blucher, $9,500.

Toronto, Ont.
Tenders will be received until June 10th by the Chairman of the Hydro-Electric Commission, 226 Yonge Street, for the supply of motor generator sets. Plans, etc., at office of Purchasing Agent, 15 Wilton Avenue.

CONTRACTS AWARDED

Lockwood, Sask.
The Lockwood Rural Telephone Company, Limited, have awarded the contract for the construction of their telephone system to J. W. Shetler, Seaman's, Sask. Equipment for 57 miles of telephone line and for operation will be purchased by contractor. Approximate cost, $9,225.

Fires

Amqui, Que.
Fire has destroyed two hotels, belonging to M. Guay and L. Pouliot, causing loss of about $8,000 to each. Both owners will rebuild.

Baie St. Paul, Que.
Fire has totally destroyed the presbytery and shed of St. Joseph Roman Catholic Mission, and the residence of Hermenegilde Dufour. Loss on residence, $2,000.

Beamsville, Ont.
The residence of A. L. Whitelaw has been destroyed by fire. Loss $4,000, insurance $3,400.

Beauport, Que.
Fire has destroyed a barn belonging to Joseph Binet, with a loss of $5,000.

Digby, N.S.
The residence of Edward Winchester, Smith's Cove, has been destroyed by fire. Loss $3,000, partially insured.

Eastview, Ont.
Fire has destroyed a residence on McArthur Road, belonging to Mrs. J. R. Cameron, 25 Clarey Avenue, Montreal. Loss $12,000, partially covered by insurance. Owner may rebuild.

Five Islands, N.S.
The residence of McGregor Bentley has been destroyed by fire.

Hull, Que.
Fire has destroyed the store of J. Pharand, 85 Champlain Avenue, causing a loss of $5,800, fully insured.

Kirkland, N.B.
The grist mill and outbuildings belonging to Leslie Kennedy have been totally destroyed by fire.

Ottawa, Ont.
Fire has destroyed a store belonging to S. Karam, Ellen and Rochester streets. Loss, $3,500.

Miscellaneous

Calgary, Alta.
E. J. Fream, Secretary to Alberta Farmers' Co-operative Elevator Company, Limited, will receive tenders for the supply of all lumber necessary for the erection of from one to ten elevators. Specifications at office of the Company, Lougheed Building.

Hamilton, Ont.
Tenders will be received until 5 p.m., June 16th, by the Mayor, for the supply of one ten-ton travelling crane, with appurtenances for hand operation, block and tackle and the necessary girders and supports. Specifications at office of City Engineer, A. F. Macallum.

Kingston, Ont.
A by-law to provide for the installation of an incinerator will be submitted to the ratepayers on June 21st. Approximate cost $7,000.

Levis, Que.
The purchase of a steam roller is contemplated by the City Council. Clerk, L. Lemieux.

Selkirk, Man.
Tenders will be received until noon, June 14th, by W. H. Montague, Minister of Public Works, Winnipeg, for the construction of an elevated steel water tank and steam pump at the Hospital for the Insane. Specifications at the Department, Winnipeg.

Vancouver, B.C.
The Shell Oil Company, Fifth and Carolina Streets, will call for tenders shortly for the erection of a distributing station.

Yarmouth, N.S.
The Town Council have ordered the purchase of 500 feet of 12-inch iron water pipe, one fire alarm whistle blowing machine, one set of storage batteries, and one fire alarm bell, 38-inch or greater. Clerk, Hiram Gaudey.

J. F. Ehrgott is receiving prices on a motor generator for a garage.

CONTRACTS AWARDED

Cape Negro Island, N.S.
The contract for the erection of a lighthouse has been awarded by the Department of Marine & Fisheries, Ottawa, to D. C. Mulhall, Liverpool, N. S. Concrete construction, under supervision of George Gordon.

Toronto, Ont.
The Board of Control have let the contract for pile driving for the Don Roadway incinerator plant to J. E. Russell, 307 Logan Avenue, at about $7,000.

Winnipeg, Man.
The Board of Control have awarded a contract for the supply of cement to Canada Cement Company, 910 McArthur Building, at $1.95 per barrel net, and for asphalt to Imperial Oil Company, Alexander and Knox Streets.

Late News Items

Cape Rich, Ont.
Tenders for the erection of a school in Section No. 8, St. Vincent, will be received until noon, June 15th, by Charles Robertson. Plans and specifications at Muxlow's Drug Store, Meaford, and with Mr. Robinson, Lot 33, Concession 9, St. Vincent.

Chatham, Ont.
A business block on King Street has been destroyed by fire, with heavy loss. Occupants, J. McClary, London, Ont., Classic Theatre and store, H. Malcolmson, King Street, Chatham, and grocery store.

East Oxford Township, Ont.
Tenders will be received until June 12th by the Township Clerk, F. G. Jackson, Oxford Centre, for the construction of about 12,000 feet of tile drain, 3,330 feet of open drain, catch basin, outlet wall, etc. Engineer, F. J. Ure, Graham Street, Woodstock.

Goderich, Ont.
Tenders on painting the exterior of Alexandra Marine & General Hospital will be received until June 14th by Judge Holt, Chairman of the Board of Trustees.

Kincardine Township, Ont.
The Township Clerk, J. Corbett, Kincardine, will receive tenders until June 15th for the construction of two bridges Plans and specifications at office of Clerk.

New Westminster, B.C.
The Liverpool Canning Company have let the contract for the erection of a cannery at Herrings Point to Fraser River Pile Driving Company, Front St. Work has been started. Approximate cost $10,000.

Thorold, Ont.
Tenders on the construction of about 1,200 feet of sanitary sewers will be received until 6 p.m., June 15th, by the Town Clerk, D. J. C. Munro. Plans and specifications at office of Town Engineer.

Toronto, Ont.
Work has been started on the construction of a pair of residences at 5-7 Fulton Street by A. & A. Grant, 837 Logan Avenue. Smaller trades may be sub-let. Brick construction, slate roofing. Approximate cost $7,000.

Vancouver, B.C.
Fire has destroyed the business block at 1150 Hastings Street, causing heavy loss to the following firms:—Canadian General Fire Extinguisher Company, C. S. Thompson & Company, hardware merchants, S. M. Anthony & Son, manufacturers, Malcolm & Souter, importers, United Paper Products Company, Libby, McNeil & Libby, canned goods merchants, W. Cline, manufacturers' agent, Galbraith Van & Storage Company and Pacific Coast Importing Company. Loss on building $200,000.

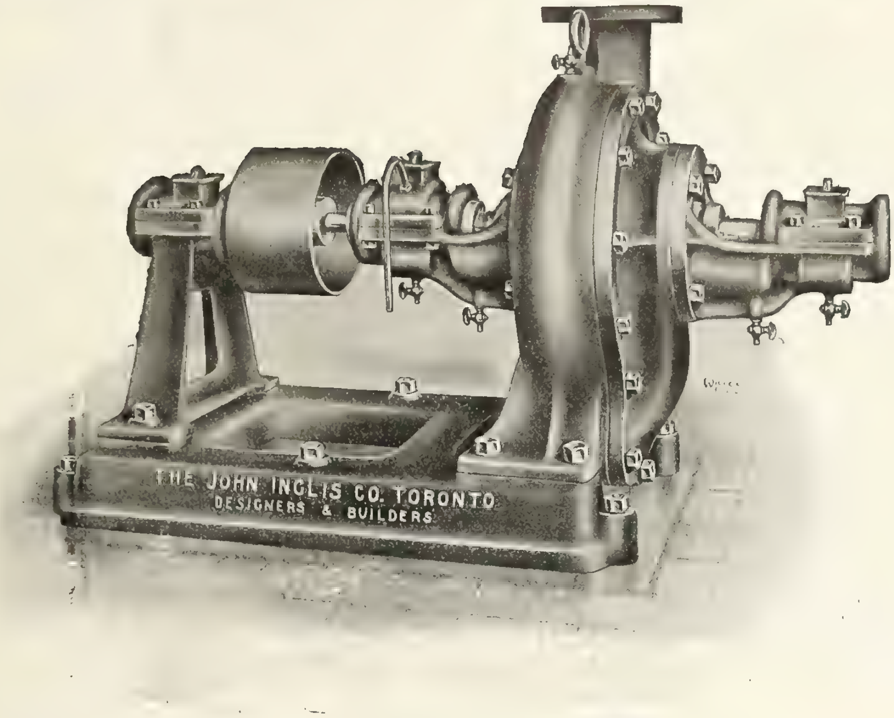
Virden, Man.
Tenders will be received until June 15th by W. Whiteford, Secretary to the Municipality, for the construction of four reinforced concrete bridges and three culverts. Plans and specifications at office of Highway Commissioners, Winnipeg, and of the Secretary.

Tenders on a quantity of road grading will be received until June 15th by W. Whiteford, Secretary to the Municipality of Wallace. Plans and specifications at office of Highway Commissioners, Winnipeg, and of the Secretary, Virden.

Whitby, Ont.
Tenders will be received until June 15th by W. Grayson Brown, Architect, Clyde Block, Hamilton, for the erection of alterations and additions to the High School. Plans and specifications at office of the Architect, and at the Builders' Exchange, 154 Simcoe Street, Toronto.

Winnipeg, Man.
Tenders will be received until noon, June 12th, by the Minister of Public Works, Winnipeg, for the supply of approximately 34,000 feet of No. 1 B. C. fir for Drainage District No. 19, f.o.b. McCreary, Man. Plans and specifications at Department, Winnipeg.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

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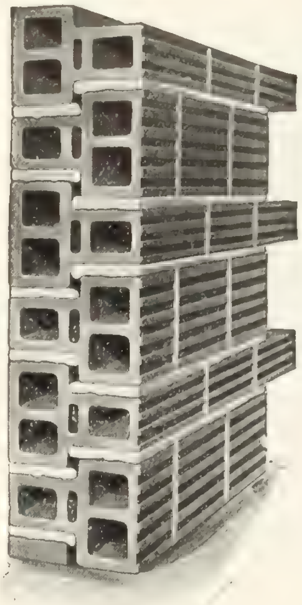

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Builds like a Thermos Bottle

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Safety in a healthful way because no moisture can seep in. There are no mortar joints extending through the wall.

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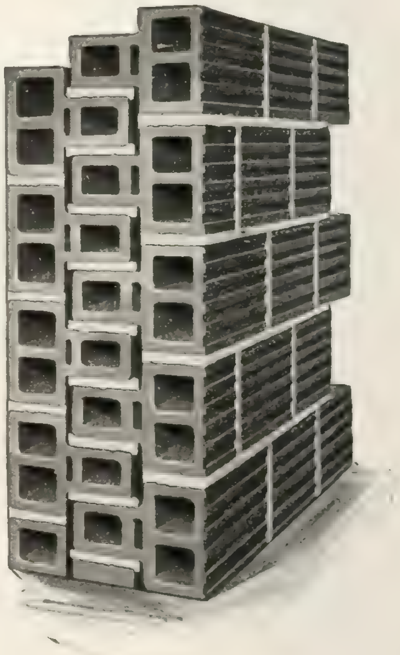

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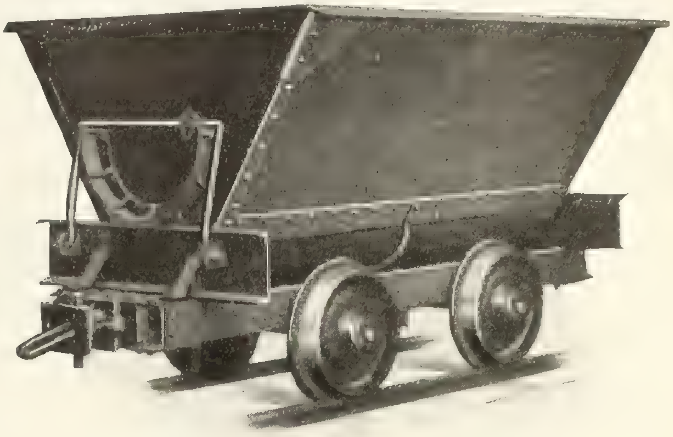

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Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton Mifflin & Company. 98 pages, illustrated. Price $1.00.

British & Foreign Building Stones, by John Watson, Published in 1911 at the University Press, Cambridge, England. 483 pages. Price 50 cents.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

Contract Record
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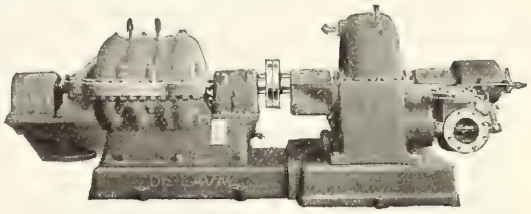

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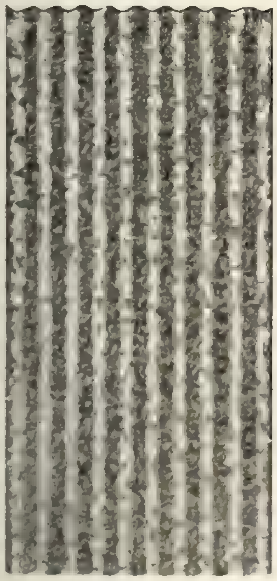

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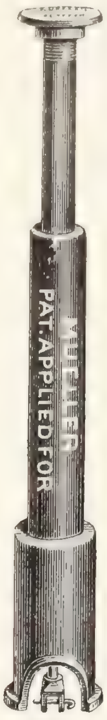

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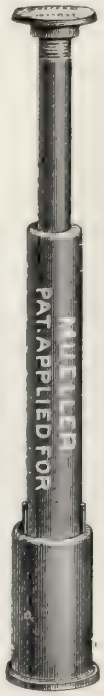
YOU can rake the country with a fine tooth comb and not find its equal. The leading cities of Canada have adopted this box because it has been demonstrated to be superior to anything of the kind on the market. More satisfaction and less expense than any box ever offered the trade. An investigation of its merits will make you its friend and user. Will you investigate.



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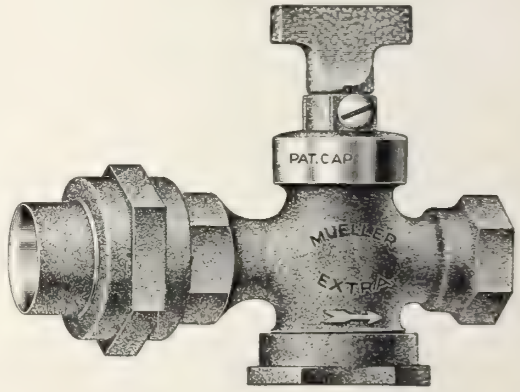
MUELLER

Lead Flange Curb Cocks

Every user of Mueller Lead Flange Curb Cocks is assured of curb connections that will give him no trouble. We take especial pride in making curb cocks that will measure up to the most exacting requirements. Good patterns and good metal are their foundation, and expert workmanship and our 200 pound hydraulic pressure do the rest. Any user of Mueller Lead Flange Curb Cocks will tell you how good they are.

There is an UNCONDITIONAL GUARANTEE back of them.



5351

C. R.

H. Mueller Mfg. Co.
Ltd.

Sarnia, Ont.

Send me your general catalog and quote me prices on Curb Cocks and Service Boxes.

Signed ....

City..................... *Prov*.........................

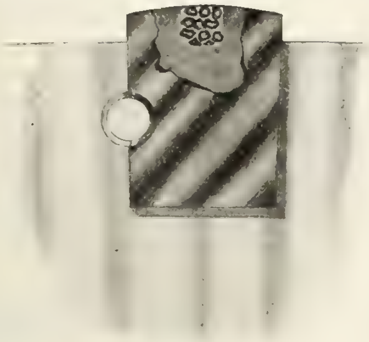
Made in Sarnia, Canada

H. Mueller Mfg. Co., Limited

Sarnia, Ontario

Makers of High Grade Water, Plumbing and Gas Brass Goods

Save 50% on Stone Sawing



Anderson "Diamond Reinforced" Saw Tooth

After costly experimenting, we have produced a Saw Tooth which enables diamond saw owners to reduce their cutting (independent of labour) by 50 per cent.

This Tooth is the "ANDERSON REINFORCED DIAMOND SAW TOOTH."

This Tooth contains, instead of one solid diamond, a number of small pieces making up the same weight. The double advantage being that it COSTS LESS and LASTS LONGER.

With the Reinforced Diamond Tooth the diamond is inserted in a broken condition, and perfectly reinforced with steel. As the tooth wears down only small pieces can go to waste, mere dust, and it is impossible for them to suffer loss through entire or partial breakage so common with teeth cutting the harder building stones.

When the first layer of the small pieces have done their work and are worn away, the second layer comes into cutting action, and so on, until the teeth are worn out.

Write us for prices.

Geo. Anderson & Co.
of Canada Limited
QUEBEC BANK BUILDING,
MONTREAL

Bend It!
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Seam It!

TONCAN METAL SHEETS

Will withstand all of this better than any other sheet metal made from iron ore.

The above photograph shows a piece of No. 16 gauge TONCAN METAL which was subjected to the severe and unusual strain of hydraulic hammering without breaking.

Besides—

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Resists Rust and Corrosion

The durability of Toncan Metal has been proven by years of service under conditions that would rapidly destroy ordinary sheet metal.

There is no purer, no more durable or more economical sheet metal made from iron ore than Toncan Metal.

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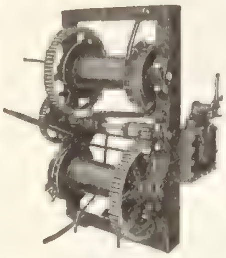

Motor Crab

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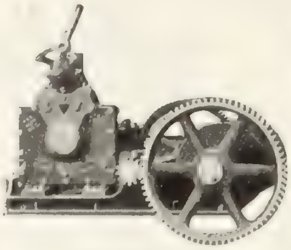
Grand Haven, Mich.



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Sand, Gravel and Crushed Stone

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Our prices are right and our service good.

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Ornamental Lighting Poles

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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

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"Queenston Blue" Limestone

Specify and get the best Canadian Stone.

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Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

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Now of all times the suggestion of using only Canadian-made building materials should have double force. Keep the "Metallic" catalogues beside you and correspond with us—you'll find we meet your every need promptly and economically with goods that are CANADIAN OR BRITISH MADE THROUGH AND THROUGH.

The "Metallic" line includes "Eastlake" Steel Shingles; "Empire" Corrugated Iron; Steel Siding, Ceiling and Wall Plates; "Hayes" Patent Lath; Skylights; Ventilators; Galvanized or Copper Cornices; Fire-proof Doors and Windows; Well Curbing; Culverts; Conductor pipe and Eave-troughs.

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Manufacturers—Toronto & Winnipeg

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TRIDENT Frost-Proof Water Meters

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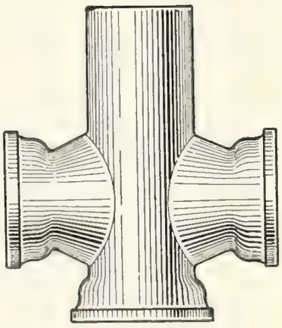

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Large stocks always carried on hand.
Prompt shipments.

Warren Foundry and Machine Co.

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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10 in pine shelving, $33 to $36; 7/8 x 12 in. pine shelving, $45; No 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.50; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. yd. net cash. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $5.05 per 100 lbs.; Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15½c basis per pound; British manilla, 13c basis; African hemp, 13c; sisal rope, 10½c basis; lath yarn, 9¾c. Boiled linseed oil—in barrels, 82½c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles. beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots. f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY

LIMITED

BAR STEEL

Warehouse Stocks:
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WIRE NAILS and other **WIRE PRODUCTS**

"Pillar Brand"

Hardwall Plaster

"Pillar Brand" hardwall plaster is made from the purest Nova Scotia Rock, calcined and prepared by expert workmen under experienced supervision.

"Pillar Brand" plaster is mixed with the highest grade goat and cattle hair, thoroughly washed and specially prepared.

We also make cement plaster, whitewall finish, plaster of paris, and land plaster. Shipments by rail or water.

Write us for prices.

The Iona Gypsum Co., Limited

Head Office, Sydney, N. S. *Mills,* Iona, N. S.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 30 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $25; fire clay, $12 per ton.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

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Vancouver prices f.o.b. warehouse:

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SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

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Mixed paint—per gal. $2.50 to $2.75.

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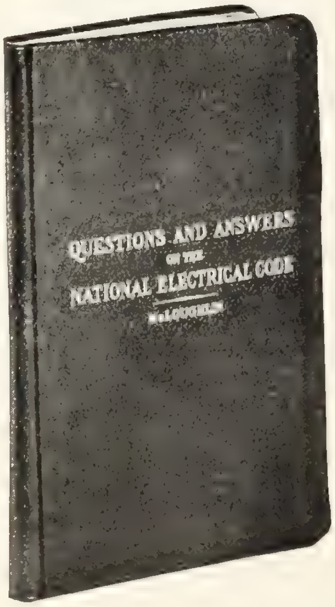

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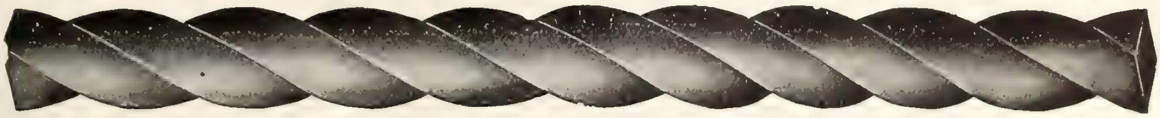

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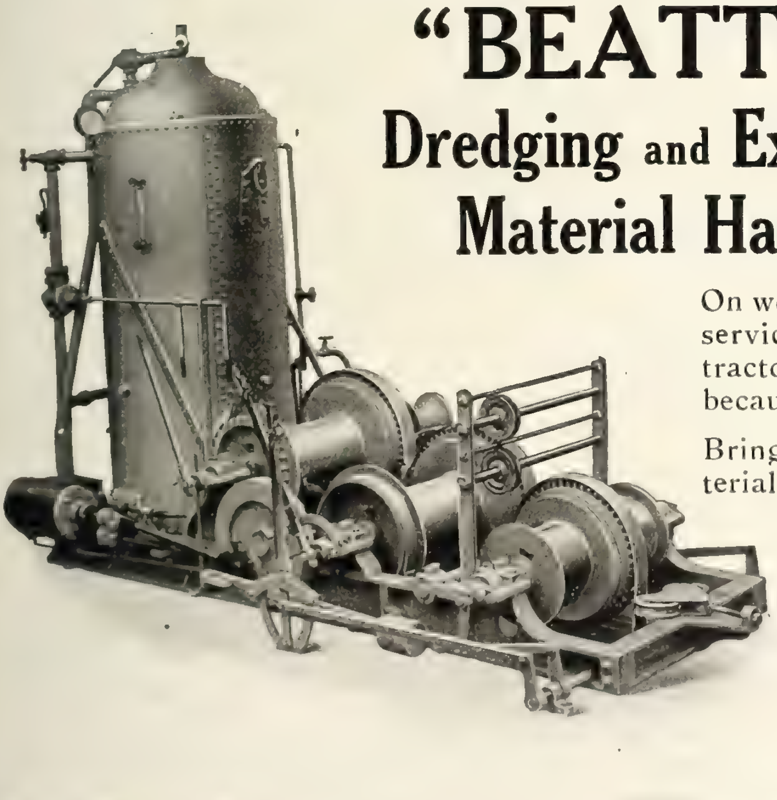

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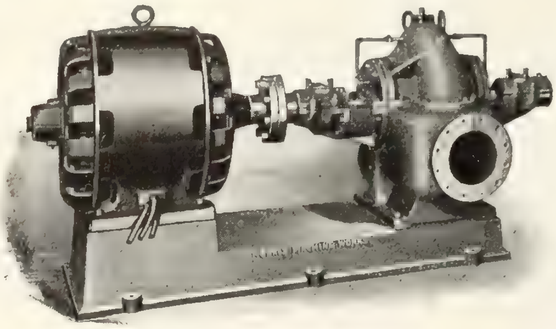

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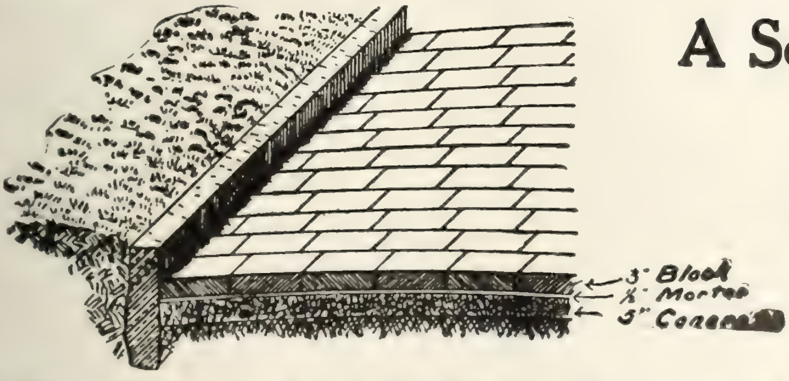

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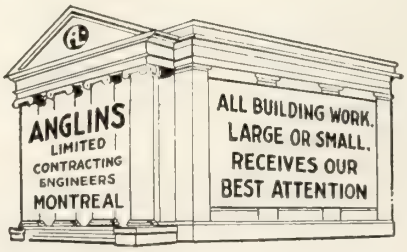
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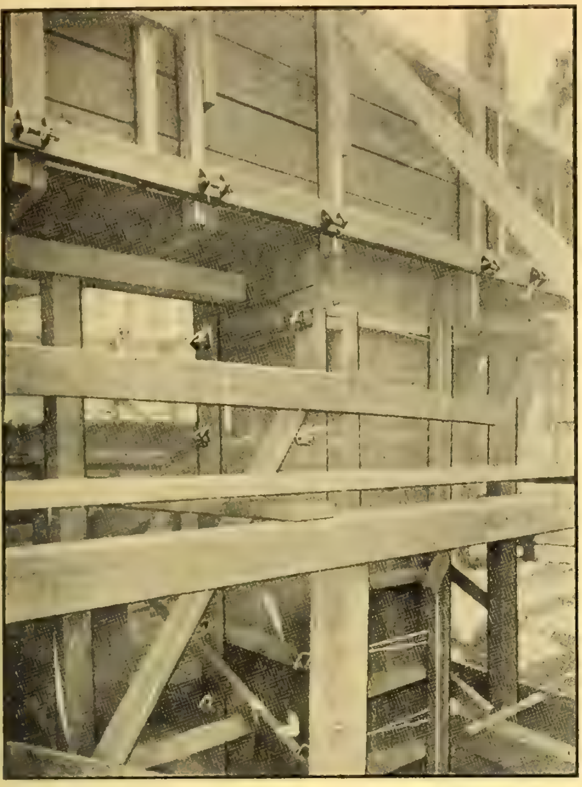

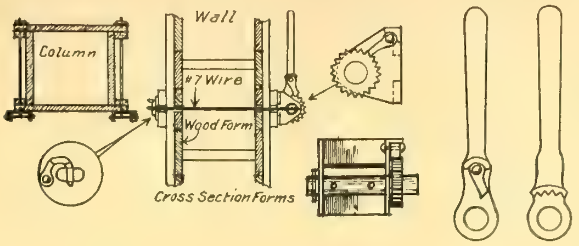

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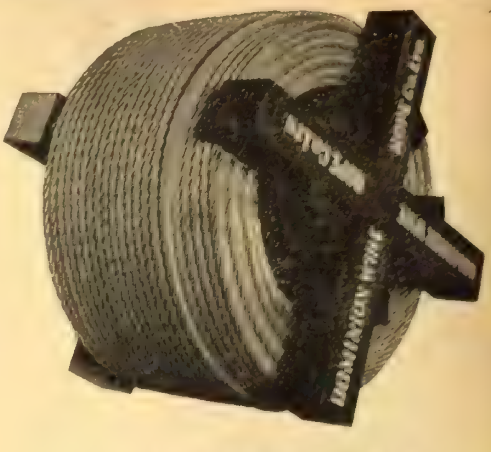

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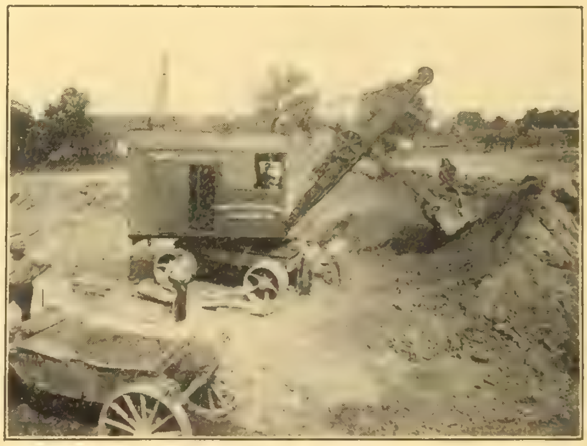

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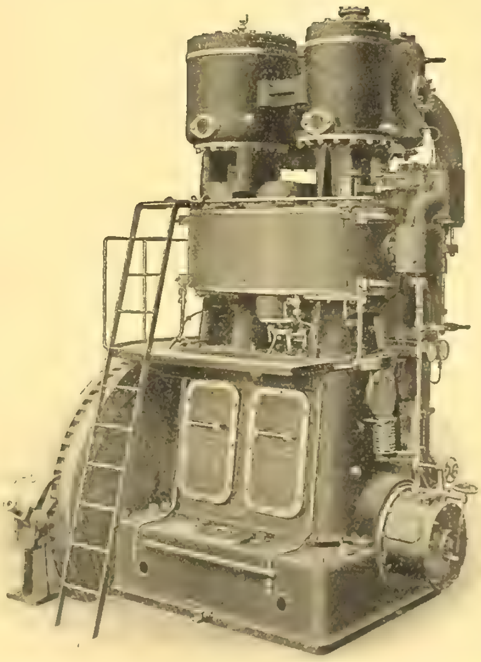

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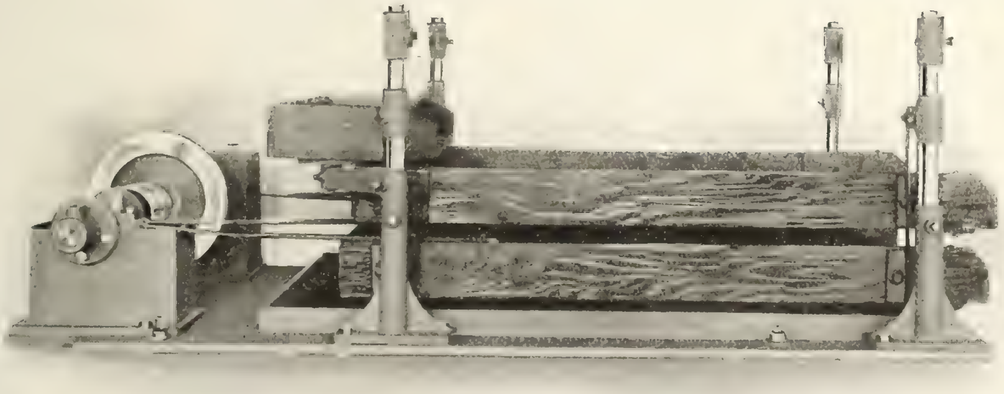

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Belting (Conveyor, Thresher, etc.)
Can. Consolidated Rubber Co.

Blast Hole Drills
Armstrong Manufacturing Co.
Hopkins & Co., F. H.

Blowers and Compressors
Canadian Blower and Forge Co.
Can. Ingersoll-Rand Co., Ltd.
De Laval Steam Turbine Co.
E. Laurie Company
Sheldons Limited
Sturtevant Co. of Can., Ltd., B. F.
Turbine Equipment Company

Boilers
Beatty & Sons, M.
Inglis Company, John
Marsh & Henthorn
McDougall Caledonian Iron Wks.

Boxes-Junction
Standard Underground Cable Co. of Canada Limited

Brick
American Enamelled Brick Co.
Bradford Pressed Brick Co.
Hydraulic Press Brick Co.
Interprovincial Brick Co.
Maloney, John.
North-Western Terra Cotta Co.

Brick Dryers
Bechtel, B. E.
Canadian Blower and Forge Co.
Sheldons Limited

Buckets
Beatty & Sons, M.
Browning Company
Cleaton Company R. E.
Hopkins & Co., F. H.
Lecky & Collis
Manitoba Bridge & Iron Works
Sudbury Construction & Machinery Company

Brick Machinery and Supplies
Bechtel, B. E.
Crossley Machine Company
Sheldons Limited

Brick Coating
Wadsworth Howland Co.

Bridges (Steel)
Canadian Bridge Company
Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
Dickson Bridge Works
Dominion Bridge Company
Hamilton Bridge Works Co.
Mackinnon-Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
National Bridge Company
Pittsburgh-DesMoines Steel Co.
Sarnia Bridge Company
Structural Steel Company
Standard Steel Construction Co.

Builders' Hardware
Aikenhead Hardware Limited

Cable
Canada Wire & Cable Company
Dominion Wire Rope Co., Ltd.
Standard Underground Cable Co. of Canada, Limited

Casements
Hope & Sons, Henry
Trussed Concrete Steel Co.

Cast Stone Blocks
Cast Stone Block & Machine Co.

Cement
Britnell & Company
Interprovincial Brick Co.
Maloney, John.
Morrison & Co., T. A.
Rogers Supply Company

Cement Mill Machinery
Hull Iron & Steel Foundries

Cement Guns
Cement Gun Company

Cement Waterproofing
Ceresit Waterproofing Co.

Centrifugal Blowers & Compressors
De Laval Steam Turbine Co.
E. Laurie Company.
Turbine Equipment Company

Ceresitol
Ceresit Waterproofing Co.

Chains
Woodhouse Chain Co.

Chain Blocks
Morris Crane & Hoist Co., Herbert

Chimneys (Reinforced Concrete)
Laurie Company, E.
Turbine Equipment Company

Coal Chutes
Manitoba Bridge & Iron Works

Coal Handling Apparatus
Beatty & Sons, M.
Browning Company

Concrete Block Machines
London Concrete Machinery Co.

Concrete Mixers and Appliances
Canadian Fairbanks-Morse Co.
Goold, Shapley & Muir Co.
Hopkins & Co., F. H.
Lecky & Collis
London Concrete Machinery Co.
Woodstock Concrete Mach. Co.

Concrete Form Clamps
Railway Contractors Supply Co.

Conduits
Can. H. W. Johns-Manville Co.
Conduits Co., Ltd.
Orpen Conduit Co., Ltd.
Ric-wiL Underground Pipe Covering Company

Contractors
Anglins Limited
Wells & Gray

Contractors' Plant & Supplies
Beatty & Sons, M.
Browning Company
Can. Fairbanks-Morse Company.
Canadian Equipment Company
Dake Engine Company
Dominion Lime Company
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Lecky & Collis
Marsh & Henthorn
Morris Machine Works
Montreal Locomotive Works
Railway Contractors Supply Co.
Stinson-Reeb Builders' Supply Co.
Sudbury Construction & Machinery Company

Contractors' Flare Lights
Sudbury Construction & Machinery Company

Conveying Machinery
Dull Company, Raymond W.
Goodwin, Barsby & Co.
Sturtevant Co. of Can., Ltd., B. F.

Core Drills
Can. Ingersoll-Rand Co., Ltd.

Corrugated Iron
Can. H. W. Johns-Manville Co.
Metallic Roofing Co.
Pedlar People Limited
Sarnia Metal Products Company

Couplings
Can. Consolidated Rubber Co.

Cranes, Travelling and Locomotive
Browning Company
Hopkins & Co., F. H.
Morris Crane & Hoist Co., Herbert
Pollard Mfg. Company

Crushed Stone and Granite
Canada Crushed Stone Corporation
Canadian Equipment Company
Crushed Stone, **Limited**
Hagersville Contracting Co.
Smyth & Ryan

Crushers (Stone and Rock)
American Road Machine Co.
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Lecky & Collis
London Concrete Machinery Co.

Culverts
Pedlar People

Damp Proof Coating
Ceresit Waterproofing Co.

Derricks and Derrick Fittings
Aikenhead Hardware Limited
Beatty & Sons, M.
Hopkins & Co., F. H.
Marsh & Henthorn, Limited
Pollard Mfg. Company

Door Hangers
Allith Mfg. Company

Dredging Sleeves
Can. Consolidated Rubber Co.

Dredges
Beatty & Sons, M.
Browning Company
Canadian Equipment Company
Hopkins & Co., F. H.

Drills
Canadian Blower and Forge Co.
Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

Dump Cars, Wheels, etc.
Bechtel, B. E.
Canadian Equipment Company
Hopkins & Co., F. H.
Manitoba Bridge & Iron Works
Marsh & Henthorn
National Steel Car Company
Sheldons Limited

Dump Carts and Wagons
Canadian Equipment Company
Deere Plow Co., John
Tiffin Wagon Co.
Watson Wagon Co.

Drying Apparatus
Sturtevant Co. of Can., Ltd., B. F.

Electricians' Gloves
Can. Consolidated Rubber Co.

Electricians' Plugs
Can. Consolidated Rubber Co.

Electric Fans
Sturtevant Co. of Can., Ltd., B. F.

Electric Air Rock Drills
Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
Gent & Company

Electric Steel Castings
Electric Steel & Metals Co.

Elevator Doors
Ormsby Company, A. B.

Elevators
Chelsea Elevator Company
Roelofson Elevator Works
Turnbull Elevator Co.

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American Enamelled Brick & Tile Company

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Dull Company, Raymond W.
Hopkins & Co., F. H.
Pawling & Harnischfeger

Exhaust Heads
Canadian Blower and Forge Co.
Sheldons Limited

Engines
Canadian Blower and Forge Co.
Can. Fairbanks-Morse Company.
Hopkins & Co., F. H.
Inglis Company, John
Laurie & Lamb
McDougall Caledonian Iron Wks.

Engineers (Civil and Mechanical)
Bowman & Connor
Cape Company, E. G. M.
Chipman & Power
Dominion Engineering & Inspection Company
Farmer, John T.
Galt Engineering Co., John
R. S. & W. S. Lea.
McDougall, Geo. K.
Pullar, H. B.

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Trussed Concrete Steel Co.

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Sheldons Limited
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Can. Consolidated Rubber Co.

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American Water Softener Co

Filtration Plants
verMehr Engineering Co., John

Fire Brick
Smyth & Ryan

Fire Escapes
Manitoba Bridge & Iron Works
McGregor & McIntyre

(Continued on page 12)

TRADE MARK

Hull Iron & Steel Foundries, Limited

Head Office and Works - HULL, QUEBEC

Manufacturers of Steel Castings

Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Repair parts for Stone Crushing Plants, Mining Machinery and Cement Mills our specialty.

Machine Moulded Gears

any size up to 18 feet in diameter made without patterns.

We solicit your patronage and prompt attention will be given to any orders.

LONDON Batch Mixer

LOOK HOW HIGH THE SKIP RAISES! Not necessary to pound the bottom out of the skip in order to charge the drum.

London Batch Mixers are Built to Last a Life Time. They will produce a **Batch of Concrete every Sixty Seconds. A Creamy, Smooth Mixture. Just what your Engineer is looking for.**

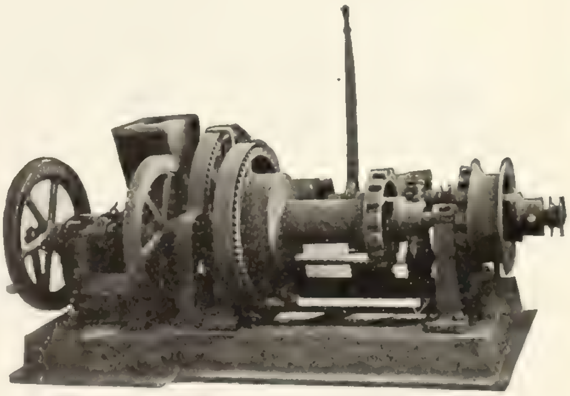
Why two thousand in use? Because every Mixer sold sells ten more.

We make **Twenty-three different sizes of Mixers.** Send for Catalogue No. 1.

CHAMPION HOIST ⟶

Direct connected. No lost power. Built very strong. **A high grade hoist at a moderate price.** We make a full line of Hoists, both Gasoline and Steam.
Send for Catalogue No. 23, stating requirements.

London Concrete Machinery Co., Limited
LONDON, ONTARIO
Branches and Agencies in every large City in Canada.
Worlds Largest Manufacturers of Concrete Machinery and Cement Working Tools.



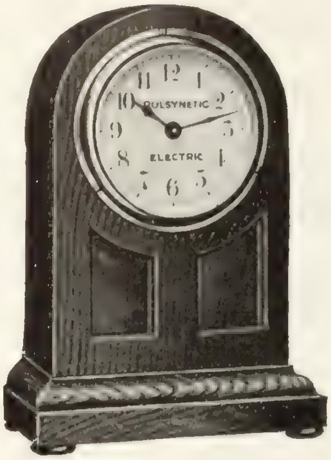


Fig. C 21. Mantel Clock

ARTISTIC MERIT

as well as accuracy in Time-keeping is embodied in all Pulsynetic Electric Clocks. No matter whether they are to be fixed in the Residence, Office, Factory, Warehouse, or Tower, we have the correct design at the right price.

One master transmitter controls any number of dials, irrespective of size or position and never wants winding.

Architects, Engineers and all interested in Correct Time should send at once for our Book Five, or full particulars and prices may be obtained from:—

W. Ashall
442 Sherbourne St.
TORONTO

Gent & Co., Ltd.

Leicester, Eng.

Cables, Lodestone

KERR

Gate Valves
and
Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited

WALKERVILLE, ONTARIO

8 x 8 x 24 inch Granite Rock Face Block

Molds for Casting

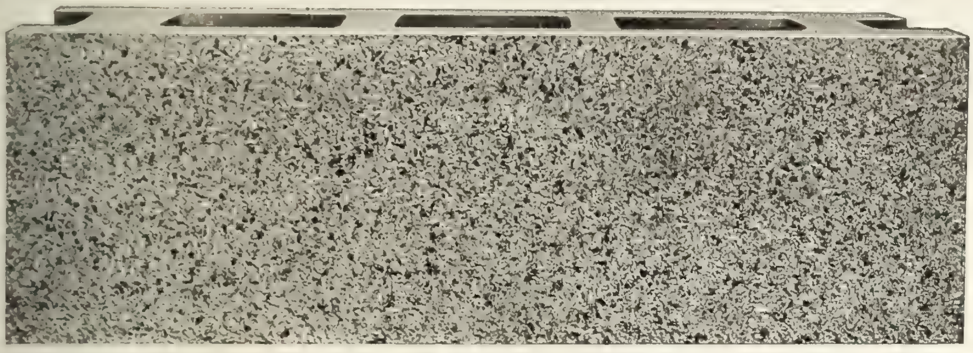
Waterproof Hollow Cement Building Blocks

With Granite Faces

THEY COST LESS — THEY SELL FOR MORE

YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited (Zagelmeyer System)

298 Howard Avenue, WINDSOR, ONTARIO

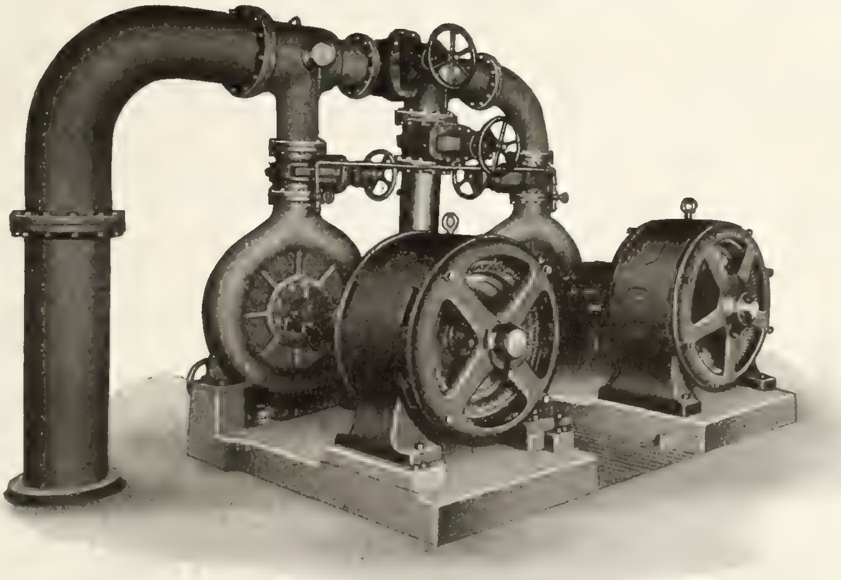
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Manufacturers of

Iron Fire Escapes

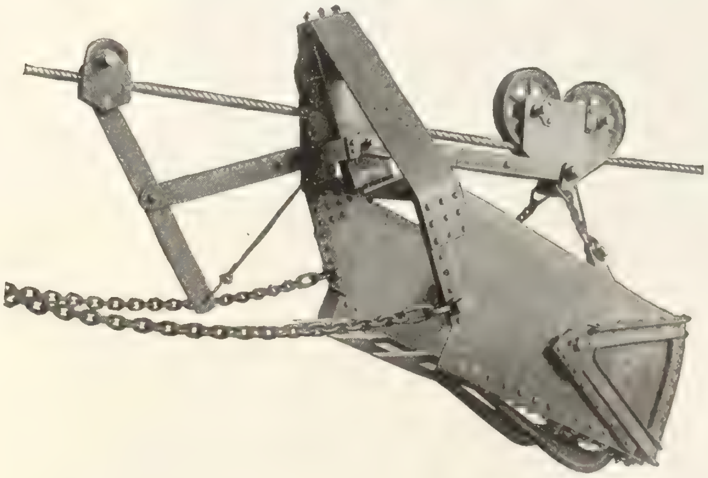
Marquise, Covered Ways, Balconies, Gates and Railings, Collapsible Gates and Fire Door Fittings

Aikenhead Architectural Metal Works

364-370 Richmond St. W.,
TORONTO, ONT.

"Dull" Drag Line Excavator

This "Dull" cableway excavator is the most practical and cheaply operated device made for digging materials either above or below water. It is shovel, conveyor and elevator combined, and is operated by one man.



Adapted to excavating and conveying earth for fills, sand and gravel handling, taking material from lakes and river beds, etc. The "Dull" bucket is the most efficient and durable machine of its kind on the market. Reduces the cost of handling material to a minimum.

The rear dump feature permits of very rapid operation and the load is discharged automatically without additional strain on cables or hoist.

Write for descriptive Bulletin

The Raymond W. Dull Co., 111 Washington St., **Chicago**
Western Sales Agents—**Bentz-Richardson Co., WINNIPEG** **Mills Bros. 215 Ryrie Bldg., TORONTO**

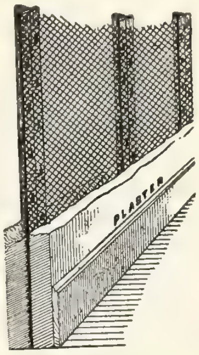
PEDLAR'S "PERFECT" PRODUCTS
MADE IN CANADA

Contractors and Engineers Specify
PEDLAR'S "PERFECT" PRODUCTS

Pedlar's "Perfect" Products are used in place of wood by progressive builders everywhere in Canada. **Pedlar's "Perfect" Expanded Metal Lath,** and other fire-proofing necessities ensure longer life of buildings and perfect fire protection, with warmer buildings in winter and cooler in summer.

PEDLAR'S "PERFECT" EXPANDED METAL LATH

provides the best surface known for bonding cement or plaster to flat surfaces. Made of highest grade unpickled sheet metal and supplied either painted or galvanized. Furnished in large sheets, size 96 x 24 inches ready for use. Always specify with Pedlar's "Perfect" Lath our **Steel Corner Beads**—also our **"Perfect" Steel Wall Plugs**—and our **"Perfect" Wall Ties** for brick walls.



Write Nearest Branch for Lath Booklet "C. R."

THE PEDLAR PEOPLE, Limited

(Established 1861)

Executive Office and Factories: OSHAWA, ONT.

Branches: Montreal Ottawa Toronto London Winnipeg 68-P

Largest Steel Guy Derrick In Canada

Made in Canada—By the Power of Niagara

Capacity—35 tons	**Mast—90 ft.**
Boom 75 ft.	**Bull Wheel—16 ft.**

High class steel derricks of large capacity are our specialty, all sizes from 5 to 50 tons.

Electric Hoists—Cranes—Derrick Irons

Stone and Marble Working Machinery

POLLARD MFG. CO.
LIMITED
Niagara Falls, Canada

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

- **Fireproof Doors and Windows**
  - Hope & Sons, Henry
  - Ormsby Company, A. B.
  - Pedlar People Limited
  - Steel & Radiation Limited
  - Trussed Concrete Steel Co.
- **Floor Hardener**
  - Ceresit Waterproofing Co.
- **Force Cups**
  - Can. Consolidated Rubber Co.
- **Fuel Economizers**
  - Sturtevant Co. of Can., Ltd., B. F.
- **Furnaces,**
  - Toronto Furnace & Crematory Company
- **Fuse (Safety Blasting)**
  - Lecky & Collis
- **Forges**
  - Canadian Blower and Forge Co.
  - Sheldons Limited
- **Form Clamps**
  - Peerless Form Clamp Co.
- **Gaskets**
  - Can. Consolidated Rubber Co.
- **Gas Engines**
  - Goold, Shapley & Muir Co.
- **Gasoline Engines**
  - Canadian Fairbanks-Morse Co.
  - Goold, Shapley & Muir Co.
  - London Concrete Machinery Co.
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  - De Laval Steam Turbine Co.
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  - Consolidated Glass Company
  - Excelsior Plate Glass Co.
  - Luxfer Prism Company
  - Pilkington Bros.
  - Toronto Plate Glass Imp't'g Co.
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  - Dull Company, Raymond W.
- **Hammer Drills**
  - Canadian Ingersoll-Rand Co.
- **High Pressure Pipe Lines**
  - Pittsburgh Valve, Foundry & Construction Company
- **Heating Apparatus**
  - Canadian Blower and Forge Co.
  - Sheldons Limited
  - Sturtevant Co., of Can., Ltd., B. F.
- **Hose, Garden and Lawn**
  - Can. Consolidated Rubber Co.
- **Hoisting Apparatus**
  - Beatty & Sons, M.
  - Browning Company
  - Canadian Ingersoll-Rand Co.
  - Gillis & Geoghegan
  - Goold, Shapley & Muir Co.
  - Lecky & Collis
  - London Concrete Machinery Co.
  - Marsh & Henthorn
  - Morris Hoist & Crane Co., Herbert
  - Pollard Mfg. Company.
  - Pawling & Harnischfeger.
- **Hoisting Engines**
  - Beatty & Sons, M.
  - Hopkins & Co., F. H.
  - Marsh & Henthorn, Limited
- **Hydrants**
  - Canada Iron Corporation
  - Gartshore-Thompson Pipe Co.
  - Kerr Engine Company
- **Incinerators**
  - Ideal Incinerator & Contracting Company, Limited
  - Toronto Furnace & Crematory Co.
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  - Can. H. W. Johns-Manville Co., Ltd.
  - Standard Underground Cable Co. of Canada, Limited
- **Industrial Cars**
  - Hopkins & Co., F. H.
  - Bechtel, B. F.
- **Interior Finish and Doors**
  - Canada Office & School Fur. Co
- **Jib Cranes (all kinds)**
  - Morris Crane & Hoist Co., Herbert
- **Kilns**
  - Canadian Blower and Forge Co.
  - Sheldons Limited
  - Sturtevant Co. of Can. Ltd., B. F.
- **Kyanized Spruce**
  - Berlin Mills Company
- **Lath Board**
  - Bishopric Wall Board Co.
- **Lime**
  - Dominion Lime Company
  - Maloney, John
  - Standard White Lime Co.
- **Lighting and Pumping Installations**
  - Can. H. W. Johns-Manville Co., Limited
- **Locomotives**
  - Canadian Equipment Company
  - Montreal Locomotive Works
- **Marble Working Machinery**
  - Pollard Mfg. Company
- **Metal Lath**
  - Metallic Roofing Company
  - Noble, C. W.
  - Pedlar People Limited
  - Steel & Radiation Ltd.
  - Trussed Concrete Steel Co.
- **Metallic Roofing**
  - Pedlar People Limited
- **Mechanical Draft Apparatus**
  - Sturtevant Co. of Can. Ltd., B. F.
- **Meters, Water**
  - McDougall Caledonian Iron Wks
  - Neptune Meter Co.
- **Moulds for Cement Blocks**
  - Cast Stone Block & Machine Co.
- **Oil Pumps**
  - Wayne Oil Tank & Pump Co.
- **Oil Tanks**
  - Wayne Oil Tank & Pump Co.
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  - Can. Consolidated Rubber Co.
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  - Dominion Paint Works
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  - Asphalt & Supply Co.
  - Barber Asphalt Paving Company
  - Dunn Wire-Cut-Lug Brick Co
  - National Paving Brick Manufacturers' Association
  - Ontario Asphalt Block Co.
  - Paterson Mfg. Co., B.
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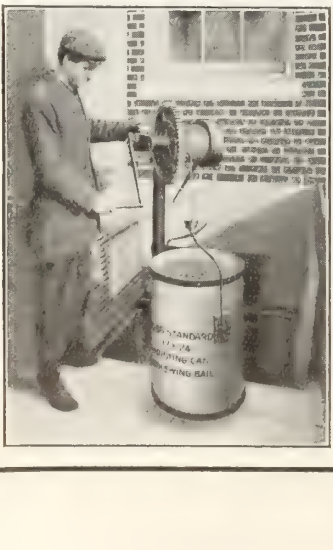
  - Canadian Pipe Co.
  - Dominion Concrete Co.
  - Gartshore-Thomson Pipe Co.
  - National Iron Works
  - Pacific Coast Pipe Co.
  - United States Cast Iron Pipe Co.
  - Vancouver Wood Pipe & Tank Company
  - Warren Foundry & Machine Co.

(Continued on Page 14)

SAUVEGARDE BUILDING
MONTREAL

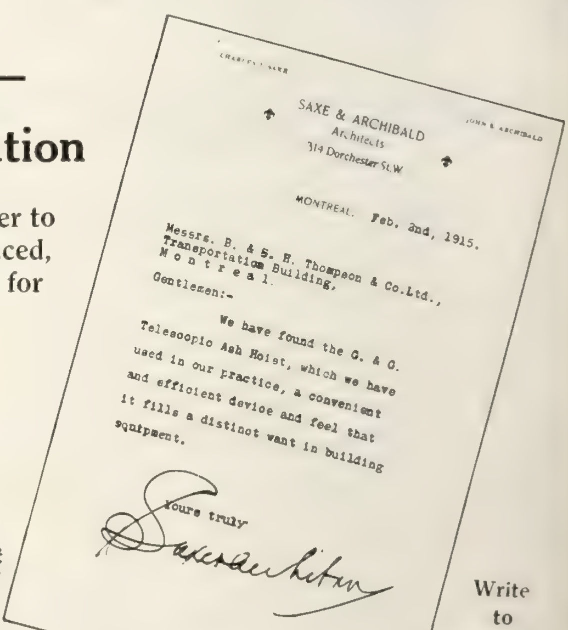
In Montreal alone, a number of the most prominent buildings are equipped with the G & G Telescopic Hoist



Another Letter—

And Another Installation

Messrs. Saxe & Archibald whose letter to our Montreal agents is here reproduced, specified the G & G Telescopic Hoist for the La Sauvegarde Building.



CHARLES J. SAXE JOHN S. ARCHIBALD

SAXE & ARCHIBALD
Architects
314 Dorchester St. W

MONTREAL. Feb. 2nd, 1915.

Messrs. B. & S. H. Thompson & Co. Ltd.,
Transportation Building,
M o n t r e a l.

Gentlemen:-

We have found the G. & G. Telescopic Ash Hoist, which we have used in our practice, a convenient and efficient device and feel that it fills a distinct want in building equipment.

Yours truly

The G&G PATENTED **Telescopic Hoist**
with compound gear and brake attachment

Raises a maximum load of 500 lbs. at a speed of 30 feet per minute, operated from sidewalk. Clean, safe and **noiseless** in operation. Only ash hoist with which it is practical for one man to perform entire removal of ashes.

"Made in Canada"

Write to nearest agent for illustrated Booklet and Prices

GILLIS & GEOGHEGAN, Sherbrooke, Que.

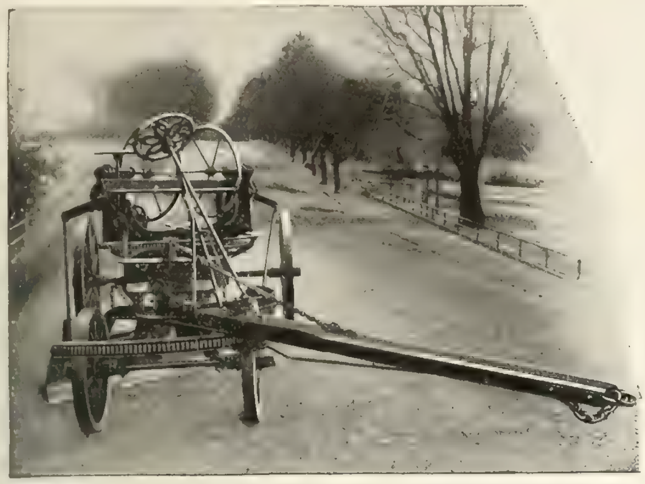
Black Building Supply Co., Ltd.
Agents for Ontario
Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

W. T. Grose, Agent for Manitoba, Saskatchewan, Alberta, **Winnipeg**

"MADE IN CANADA"



The CHAMPION Lever Road Drag is conceded by users in all parts of the country to be the most complete road drag made. It is simple, durable, capable and easily operated. We offer it as a road drag that will not fail to meet the approval of the most exacting user.

Champion Road and Contractors Outfits
A complete and varied line of all machines for
Road Building and Street Work

Manufactured by
American Road Machine Company of Canada, Limited
GODERICH, ONTARIO

TRADE **CHAMPION** MARK

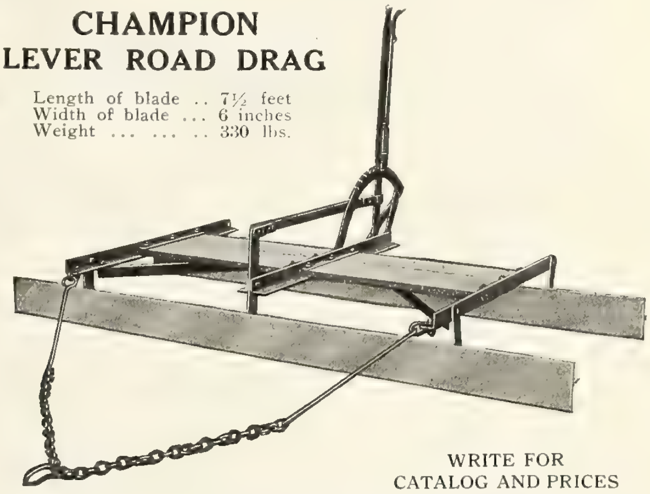
CHAMPION
OFF-SET GRADER TONGUE

This is a most important appliance for use with any grader, and is especially desirable where traction engine or other power is used for operating the Grader. Ditching is a much easier operation with the use of these off-set tongues, as it allows the teams, engine or other power to use the middle of the road at all times while the Grader may be off side either to right or left of road

The operator on driver's seat has full control at all times and can bring the machine into line with the teams or engine whenever desired.

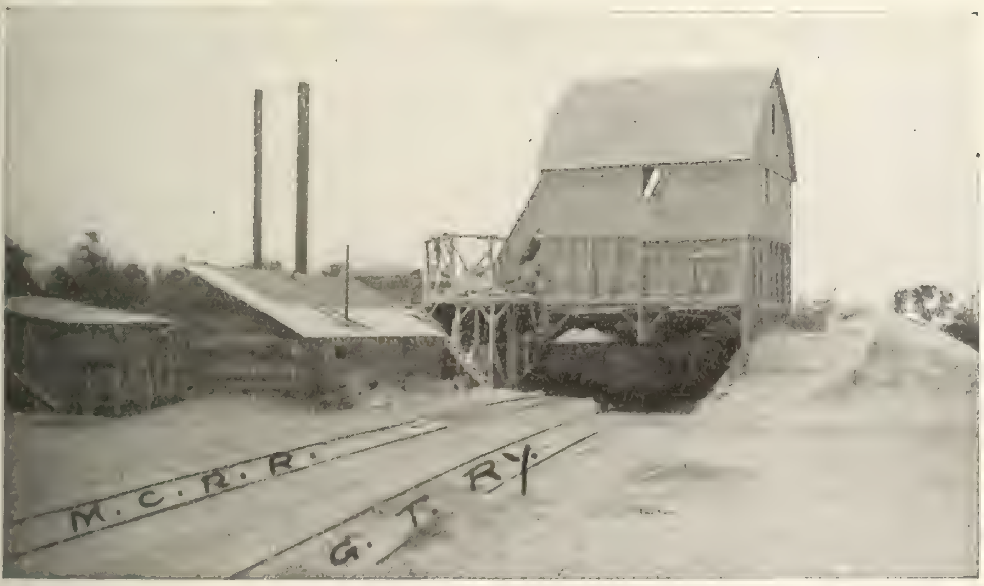
CHAMPION
LEVER ROAD DRAG

Length of blade .. 7½ feet
Width of blade ... 6 inches
Weight ... . 330 lbs.



WRITE FOR
CATALOG AND PRICES

Macadam Roads



must be built
of a

Tough
Stone

that
will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Pile Driving Machinery
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Browning Company
Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Lecky & Collis
Marsh & Henthorn, Limited

Pipe Fittings and Flanges
Pittsburgh Valve, Foundry & Construction Company

Plaster Bond
Ceresit Waterproofing Co.

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Mueller Mfg. Co., H.

Planing Mill Exhausters
Canadian Blower and Forge Co.
Sheldons Limited
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Plaster
Albert Mfg. Company
Britnell & Company
Can. H. W. Johns-Manville Co., Ltd.
Iona Gypsum Company

Plate Glass
Excelsior Plate Glass Company

Plug Drillers
Canadian Ingersoll-Rand Co.

Plumbers' Supplies
Can. Consolidated Rubber Co.

Pneumatic Machinery
Canadian Ingersoll-Rand

Power Engines
Inglis Company, John

Pressed Brick
Interprovincial Brick Co.

Pump Valves
Can. Consolidated Rubber Co.

Pumps and Pumping Machinery
Beatty & Sons, M.
Canadian Blower and Forge Co.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Cook, A. D.
De Laval Steam Turbine Co.
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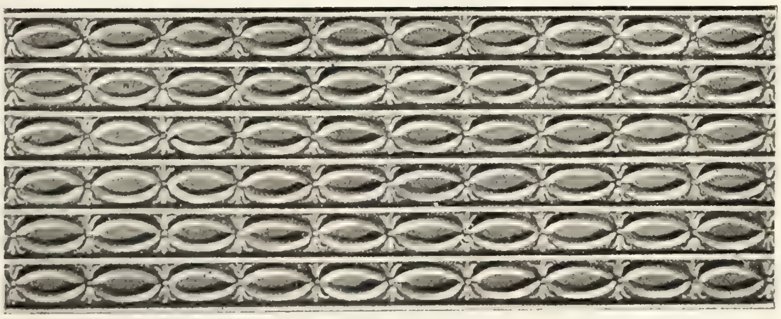

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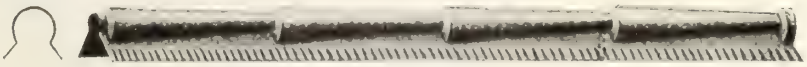

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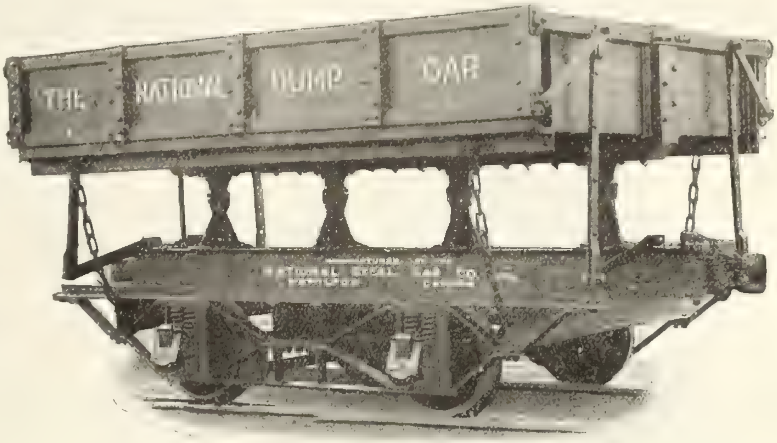

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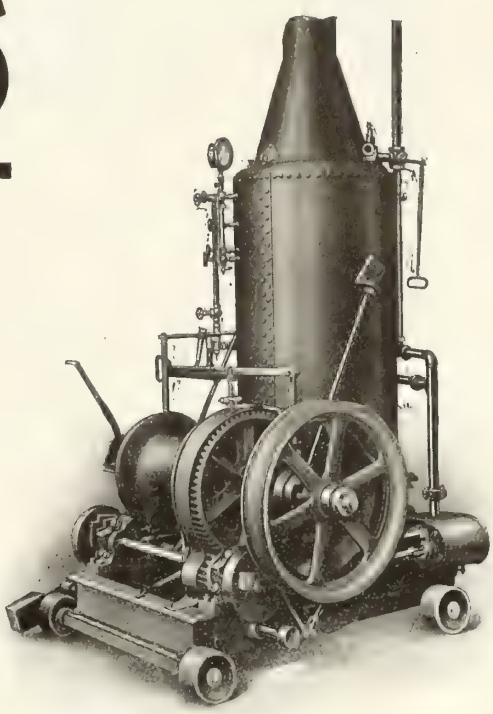

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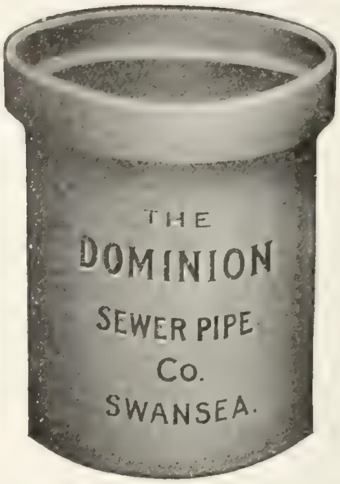

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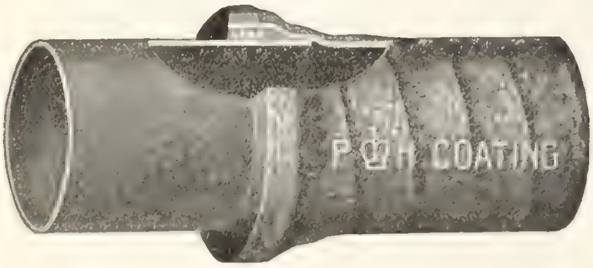

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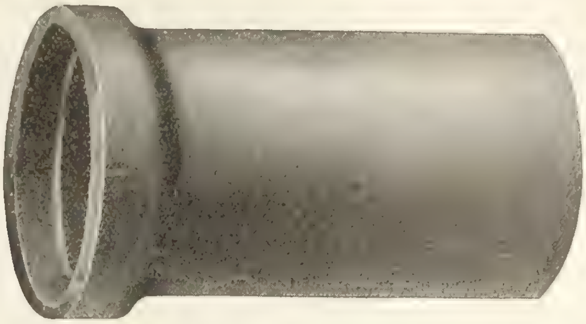

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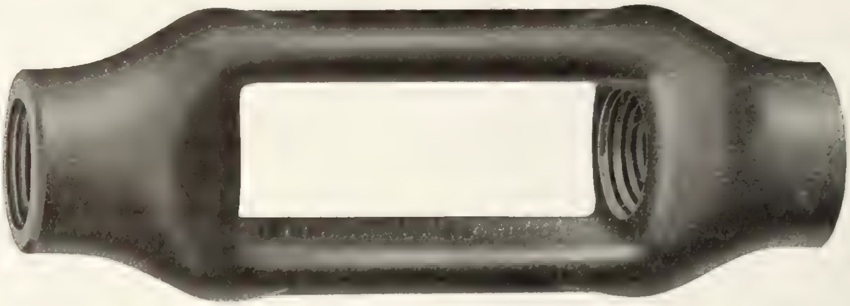

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The Personal Factor in Road Construction

JURISPRUDENCE recognizes two forms of judgment; one is based on law, and the other on equity. Law is intended to promote the interests of justice, but at times the letter of the law defeats the ends of justice, and equity becomes a consideration. We are not lawyers, but that is our conception of the meaning of these terms. We have often wondered if it were possible for the dead, hard "specification"—which at best is a compromise, limiting the hope of some owner and defining the services of some servant—to be vitalized so that the owner's wishes could be attained and the servant's services appreciated.

If one class of specification more than another may be considered a cold, dead thing, we believe that the road specification challenges competition. The owner of a road is nobody in particular. The road is not for sale. The powers that order its construction are usually not those who use it, and the majority of its users have not paid anything for it. The roadside proprietors, who pay for it only indirectly, in the majority of cases do not use it, not owning any means of locomotion other than pedestrianism, which calls for the use of roads chiefly as crossings. Pedestrians are not regarded favorably by other road users, in any case, even where no sidewalks exist. Who, then, owns the road; and to whom is its builder answerable? Yet what is a surer sign of progress and prosperity than well made and properly maintained roads? The building of bad roads, then, or the failure to use every endeavor to build good ones, is, in the first place, a form of high treason against the material interests of a community.

Everyone who uses a badly-made road—pedestrian, carter, hackman, tradesman, cyclist, autoist—suffers as the result of the builder's carelessness. And think what an uneven road means to the invalid, whose every movement is pain, and to the surgeon, the work of whose skilful hand is so dependent upon steady nerves. Who is the road builder? The contractor carries out, or endeavors to make it appear that he carries out, the specifications on which he tenders. He is responsible to the engineer who drew up those specifications. The engineer may have copied his specifications from those of some other town, or he may have prepared his own, with or without the services of a lawyer and chemist. The engineer is responsible to a Road Committee, Town Manager, or Council. The Council is the legally responsible party—and the Council is usually composed of men whose qualifications may be varied and great, but do not include any practical or theoretical knowledge of what constitutes a good form of road construction.

All of these considerations entail upon the engineer, contractor, foremen and workers a special need for conscientious, loyal service. This can be obtained only where there is goodwill and team-play. The driving, swearing, blustering foreman or boss cannot build a good road. He may build a good looking road, and may build it quickly, and add to the contractor's profits, but the maintenance of that road will cost more and its life will be shorter in proportion to the sense of injustice aroused in the minds of the men who work under him. Watch a gang working under a man whom they respect but are not afraid of, and compare it with another gang who cower in anticipation of some undeserved vituperation every time the boss comes by. In road-building, as in everything else, team-play is essential; it is good for the workmen, good for the road, and good for the community that uses the road.

The Importance of Publicity for the Engineer

WHY should we engineers be interested in publicity? Is there good reason for departing from the time-honored precept that our achievements are sufficient witnesses to their creator's ability?

He who moulds together brick and steel and stone, it matters not with what great cunning, will never rise in the estimation of those about him to a position above that of a skilled artisan. The engineer's mute witnesses of his ability are to the public mere piles of steel, long lines of railroads, or canals, or tunnels—just material things. The public must learn that we dream dreams and see visions long before a pound of material is shaped; that a part of our dreams is ever to subject the forces of nature so that man may develop the best that is in him, according to his destiny.

The man in the street is not likely to find this out unless we tell it to him in his own language. We have waited long enough for him to find it out unassisted, and our rewards bear evidence of the fruitlessness of our waiting. Unless we show that we are leaders, we shall be only workers—hewers of wood and drawers of water.

There are other reasons for proper publicity conducted by engineers, all of which may be included in the broad purpose of service to the public. One of these is to correct error and misrepresentation, so that when questions of public policy come up they will be decided in accordance with correct engineering principles rather than by the whim of the moment, directed, perchance, by some small class to further selfish ends.

The country is burdened with wastefulness where engineering skill might save vast sums. For instance, it is planned to spend a hundred million dollars on highways in New York State without adequate provision for maintenance. It is hardly possible that such a proposition would have been seriously entertained if the public had waited for the opinion of the engineering profession before making a decision. Again: Recently a proposition to spend fifty million dollars on good roads in Ohio was voted upon without any preliminary studies or surveys as to how the money was to be spent. Had the proposition been approved, the money would have been largely wasted under the direction of jockeying politicians.

At present the Government is spending millions of dollars and requiring the owners to spend many more in making a physical valuation of the railroads. When two vacancies occurred in the Interstate Commerce Commission a year or so ago, the suggestion was made to one who had the ear of the appointive power that it would be desirable to have one of the vacancies filled by an engineer. He replied that such a position required a judicial quality of mind, and that the incumbent could surround himself with all the expert service needed. His answer implied that an engineer could not be found possessing the necessary judicial quality of mind. It should be stated that the man who gave this reply was a lawyer.

There is a vast national field for furnishing engineering information to the public, which can be taken care of only by a permanent national information bureau conducted by engineers.

We have technical and research societies without number—so many that the public can hardly be blamed for believing that we are interested in material things only. Perhaps we need a national bureau to conduct and cultivate business relations with the public, including inter-society relations, publicity, employment, and legislation.

All over the country there is a growing protest against the direction of municipal affairs by the lawyer and the politician. The administration of municipal business is largely a function of engineering. Why not enable the public to see this situation in its true light and thereby perform a public benefaction as well as advance our own interests? Positions for engineers would increase in number, and compensation likewise. In the matter of seeking to prevent harmful legislation, recent events in the State of Illinois are a sufficiently strong argument to convince Chicago engineers of the need.

The Dominion Government's Works Programme

IT has been announced that the Dominion Government will continue the construction of all public works under contract in Canada. Apart from the war, the total expenditure of the Dominion will reach $200,000,000 for the year, while the war expenditure will mean an addition of $100,000,000. The total daily expenditure, therefore, exclusive of Sundays, will be about one million dollars, in order to maintain the existing programme and to carry on the Dominion's part in the war. The programme for the current year includes an expenditure upon public works of $25,000,000, on railways and canals of $27,000,000, and on capital account and works of harbour commissioners of over three and a half millions. Since the outbreak of the war the Dominion has made every effort to minimize unemployment in Canada by maintaining its programme of public works, including the I. R. C. terminals at Halifax, the Welland Canal, the Quebec Bridge, the N. T. R. and Hudson Bay Railroad, and terminal elevators and harbours at Halifax, St. John, Quebec, Montreal, Toronto, Hamilton, Port Arthur and Fort William, Vancouver, and Victoria.

Promotion by Competitive Examination

According to a committee on salaries and grades of the Municipal Engineers of New York City, promotion by examination tends to advance men who have a willingness and taste for studying civil-service methods and preparing for examinations, and to eliminate men inclined to give their best efforts to the work in hand. Especially is this true in professional technical employment beyond grades rated at $2,400 a year. Beyond such limits intelligent and fair appraisal should supersede examinations, excepting some effective and fair qualifying test.

Good men are not attracted and held by salaries alone, but by the conditions under which they work. The efficiency of the Board of Water Supply force compares favorably with any large public or private

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*From an address before the Engineering Section of the Chicago Association of Commerce by C. E. Drayer, Chairman Publicity Commitee, Cleveland Engineering Society.

engineering organization. This Board has been noted also for its esprit de corps and enthusiasm for its work. These desirable qualities, the report states, were obtained by selecting the most suitable available men for the leading positions, giving great weight, not only to technical fitness, but also to those personal qualifications which cannot be learned or rated by examinations.

How Standards of Quality for Concrete Road Materials are Rising

THE successful future of concrete roads depends upon firm adherence to superior quality concrete. Sub-grading and drainage may be good, and of course must be good for any road that is to endure, but the final criterion of a concrete road as distinguished from other construction, according to Engineering and Contracting, is the integrity and durability of the material itself—the quality of the concrete. The service to be given by concrete in no other structure calls for such perfect quality of material as is demanded in a road. This truth is not a new discovery; it has long been known to the few best students of concrete roads. The new feature is that, whereas formerly the few observed the truth and the many neglected it, now the many observe the truth and only the few neglect it. One is very strongly impressed with this change when reviewing the last season's reports of municipalities that have been building concrete roads for a few years.

The quality of concrete is determined by the quality of the raw materials, by the proportioning and incorporation of these materials, and by the curing of the deposited mixtures. To the perfection of all of these things experienced concrete road builders are paying now much more strict attention than a year ago was considered at all essential, and are urging even stricter attention in future work. Practice has reached a point where a demand exists for refinement in materials for and processes of concrete production for roads. This stage of attainment in the development of the concrete road is to our mind the finest promise that we have that the concrete road has arrived.

First, in the attention being given to ensure better concrete materials, is cement. Very few communities having much experience in concrete road building fail to provide for the thorough testing of all cement. This is essential. Few materials as widely manufactured as is Portland cement rank as more uniformly of high average quality, but all cement is not test-proof any more than are every brick and every steel bar. No road job of any size fails to receive an occasional shipment of cement that has to be rejected. The safeguard is testing. To make testing practicable and to provide direct control, commissions having concrete road work in charge are adopting the plan of furnishing all cement. Besides securing control of the testing, the road authorities by this plan avoid any tendency of the contractor to reduce the cement content of his concrete. Excessive use is prevented by holding the contractor responsible for any over-run of cement and for loss of cement bags.

Aggregates for concrete for road work need, and are receiving, increased scrutiny as to quality. Pit run gravel is not accepted by many. Stone and screened gravel are required to be graded and to be kept within narrow size limits. In some work the coarse aggregate is required to conform to a set co-efficient of wear. Inspection of sand is rigid. The dirt content and the proportion of flat flakes are being strictly limited, and it is a usual demand that the grading of particles be fairly perfect. Altogether concrete road practice in the requirements for quality of concrete aggregates is superior to that in almost all other kinds of concrete construction.

The best road construction sets a high standard of perfection in the proportioning and mixing of concrete. Set proportions are commonly abjured. The aggregate is studied to determine proportion of voids, sizes, form and gradation of particles, and the concrete content is varied to conform, and as frequently as need be, with the purpose of securing density of mixture. Duration and speed of mixing are strictly governed. One road commissioner has conducted careful tests to determine the quality of mixture produced by different numbers of revolutions and different speeds of rotation of the mixer used, and on the results has set rigid requirements for mixing time and mixer speed. Here it may be noted that individual tests are positively necessary on each work where different mixers are used; for the speed of rotation and number of turns which give the best concrete with one mixer are no criterion of what another mixer will do.

The methods of curing are numerous, and the difference in efficiency between the better methods is not great. The advance in curing methods indicated by recent practice is shown rather in the care with which all methods are carried out than in devising unique methods. The curing period is lengthened wherever possible; water is supplied liberally, and the road slab is kept continuously wet; protection from wind and sun is sought.

The preceding summary of increased refinement in conducting concrete road work can be lengthened materially by adding minor details. The fact that concrete road building is becoming a very particular task of concrete construction has, however, been clearly indicated—and that is all that it was proposed to do. The contractor whose experience has been confined to general concrete construction must be prepared to accept new standards of refinement in concrete production when he enters the field of road work. It is more important to emphasize this fact than most of the other changed conditions that concrete road construction brings, because it is less obvious than most of the others. Coincidentally it should be noted that the tendency for increased refinement is bringing an increase in concrete pavement costs. The old "dollar a yard" slogan of the concrete road enthusiast is ceasing to have much of the truth that it once had. Dollar a yard concrete roads will be built in occasional places, but the concrete road of the future will most certainly exceed materially the cost of most of the concrete roads of the past—and it should do so, for unless all indications fail it will be a much better road.

Future Practice in Sewage Disposal

By George W. Fuller

THE following opinion on the probable future changes in sewage disposal practice was given at the request of the Metropolitan Sewerage Commission of New York City, and is quoted from their final report.

Oxidation Methods

These procedures are aimed essentially at the prevention of putrefaction of sewage matter, and hence deal particularly with soluble and colloidal constituents of sewage.

Dilution.—This is the prevailing method all over the world for securing the oxidation of soluble or non-settling sewage matters wherever there is ample water to bring about satisfactory results. Without attempting to state precisely the digestive capacity of New York Harbor, it is sufficient to say that for all time to come it will oxidize under suitable conditions the clarified sewage of many millions of people. Departures from this method will be required solely in areas where the sewage cannot readily be delivered to bodies of water of sufficient volume.

The dilution method has usually been applied in this country under improper conditions. Clean water-courses can be maintained with the dilution methods, and past shortcomings should not militate against the advantages and economies of utilizing the digestive capacity of the harbor waters.

Filtration.—Where sewage cannot be applied to diluting bodies of water on account of the distance from same and the expense of delivering the sewage, filters will undoubtedly continue to serve a useful purpose. I believe the future will show no radical departures in the efficiency or cost of either sprinkling or contact filters. The tendency will be towards improvements in the design of certain details. I am clearly of the opinion that filtration has no future so far as relates to the main volume of New York sewage.

For certain areas, particularly those now comparatively sparsely populated, I think that a number of filter plants installed and operated for a period of ten to twenty years may in the end prove cheaper, even if then abandoned, than would be the case if at the outset the general plan should embody the execution of collection works for a central plant with several subdivisions.

I look for improvements in the preliminary treatment of sewage to lessen materially the odors sometimes attending sprinkling filters. For certain thickly populated districts I believe contact beds are entitled to careful consideration.

The lessening of odors requires primarily the prevention of putrefactive conditions becoming established in the unfiltered sewage by aeration, oxidizing chemicals, and probably to some extent by the application of sewage so as to minimize the opportunity for wind action to transport sewage spray.

Aeration.—I look upon aeration as a promising means of guarding against putrefaction. If conditions arise where it is necessary to deal with sewage which has to some extent undergone putrefaction I consider it possible that organic matter to a limited extent may be reduced through oxidation by air. Except for limited quantities of unstable organic substances aeration cannot be counted upon as an oxidizing agent in practice. It provides molecular oxygen, whereas the bulk of the organic matter of sewage is oxidized only by the atomic oxygen of certain powerful oxidizing agents, or the slow oxidation effected through bacterial action.

The function of aeration is essentially one of artificially prolonging the period of decomposition of sewage on an inoffensive aerobic basis. It may be that conditions will arise where the occasional application of air by artificial means will permit the dilution method to be employed, whereas without aeration or some similar treatment the dilution method would present objectionable and offensive shortcomings.

On the score of cost the aeration method for general use does not look promising; and this is particularly true of the New York conditions, where the sewage oscillates back and forth for a period of time that makes a demand on the atmospheric oxygen greater than is the case with many flowing inland streams.

Oxidizing Chemicals.—The cost of applying such chemicals as liquid chlorine and hypochlorite of lime or soda is prohibitive on account of the relatively small amount of organic matter that is oxidized. The true function of such agents is the killing of bacteria, and within certain limits they are useful as a preservative for sewage to prevent decomposition rather than to effect complete ultimate oxidation of the non-settling organic matters.

Electrolytic Treatment.—A good deal is claimed from time to time for the economical advantages derived from the application of electricity in various types of electrolytic cells in oxidizing the organic matters of sewage. In particular is this claimed where the current may be applied to sea water. While improvements in this direction may be possible, I do not believe that they are promising enough to warrant consideration of electrolytic treatment as a substitute for the dilution method.

The electrolytic production of chemicals to precipitate certain colloidal and other non-settling organic matters may prove desirable in the future and worthy of adoption under some conditions. This method would be used, however, in conjunction with settling tanks, and could be employed supplementary to such tanks without requiring material changes in the design of tanks built for plain sedimentation alone.

Clarification

The purpose of clarification devices is to prevent unsightly sewage solids appearing in the diluting water, or the formation of sludge banks in watercourses.

Fine Screens.—Fine screens afford the cheapest way of removing visible objects of sewage origin from the waters receiving sewage where such screening treatment alone is sufficient for obtaining satisfactory results. Under conditions where the limit is at times reached in the amount of clarified sewage which a watercourse will oxidize satisfactorily, settling tanks as a general rule are cheaper to install than screens, because for a given cost they will remove a greater quantity of organic matter. Where screens will suffice for a term of years—say ten or more—it is quite possible that it will prove economical to install screens first, to be followed later by settling basins as occasion demands. American experience with fine screens is quite limited and not altogether satisfactory, owing to the devices requiring much attention and repair. This has meant not only expense, but also serious interruptions in continuity of service.

Screens are employed to much better advantage in Europe, particularly in Germany. At Dresden, Frankfort and Hamburg experiences demonstrate on a large scale that it is feasible to operate moving plate screens with an opening as small as 0.04 in. At present the so-called Reinsch type of screen, as installed at Dresden, seems to be most popular. It is of the disc type, with slots about 0.085 in. wide and 1.25 ins. long.

As fine screens come into service in America I look for marked improvements in continuity of service and freedom from expensive repair costs. I do not believe that efficiency will be any greater than that indicated by European evidence unless it should result from applying to screens sewages which are fresher and less comminuted than has been the case at Dresden, Frankfort and Hamburg.

Settling Tanks.—Sedimentation for a two-hour period at the average rate of sewage flow will give as good results as it is prudent to obtain from sedimentation. For local conditions I favor single-storey tanks with hopper bottoms, as it is undesirable to septicize the sludge at its point of origin.

The construction of settling tanks along the New York water front presents some difficulties on account of the high cost of ground, complications from salt water backing into the sewers at high tide, and the necessity of caring for storm flows. I believe these difficulties can be overcome by careful engineering study.

Fine Screens vs. Settling Tanks.—My views have been already indicated in the foregoing paragraphs. But as the question has much significance in New York I will state that, in my opinion, screens are preferable to settling tanks only where it is desirable or necessary to remove only relatively large sewage matters in suspension. Where settling solids would form deposits in the watercourses if screening alone were adopted, to install settling tanks will prove wiser than to install fine screens. Available data in this country are now too meagre to allow fine lines to be drawn in this comparison. For problems of this magnitude special study should be given before construction, not only of the relative merits of the two systems as a whole, but also of the local conditions at each main sewer outlet or groups of outlets which can be conveniently united. Both screening plants and settling plants can be operated for treating fresh sewage without creating any nuisance.

Chemical Precipitation.—The use of coagulating chemicals has been known for fifty years as a helpful adjunct in removing particles of suspended matter which are so fine that they will not subside in ordinary settling tanks. The expense of the added chemicals and the large increase in the volume of the resulting sludge is such that as a general proposition chemical precipitation is not worth while.

Sludge Disposal

In the clarification of sewage there results in all cases a substantial quantity of solid matters more or less mixed with water and ordinarily spoken of as "sludge." Experience at other large seaport towns employing sewage treatment works, such as London, Glasgow, Manchester and Salford, demonstrates conclusively that the barging of sludge to the open sea is the cheapest way of disposing of the sludge without nuisance.

Cases may arise in isolated areas removed from the water front where barging to sea will not be desirable. In such cases I advise the consideration of two-storey tanks of the Imhoff type, with the drying of the sludge on drying beds so that the residue can be carted off readily.

Use for Fertilizer.—For more than fifty years efforts have been made to employ sewage sludge economically as a fertilizer. Rarely if ever has the result been a commercial success when operations were conducted on a large scale. I do not look for any substantial change in the future, although sewage sludge may perhaps be employed as a "filler" for fertilizers. In such event it is safe to assume that the users of the material coming from settling tanks would be willing to prepare it for their processes, and if this is so it would simply mean that New York would be relieved of operating barges to sea up to the limits to which sludge is diverted to fertilizer purposes. While some slight saving in the operation of barges may be accomplished, I do not look for any substantial compensation to the city from fertilizer manufacturers who might use the sludge as filler.

Incineration.—I am aware that at Frankfort, Germany, sewage sludge is freed of water by centrifuging and the application of heat in revolving drums, so that the dried sludge may be burned with other city refuse in an adjoining municipal incineration plant. While this procedure may have a future for inland cities, the expense will never be reduced to a point where this method will displace barging to sea for the sludge of a large seaport town.

Destructive Distillation.—In a small way there are some data available as to the production of combustible gases and coke by the dry distillation of sludge. The cost of removing the water is so great that the future will never see this treatment become commercially feasible.

Sterilization.—With the existing system of combined sewers, without any possibility or necessity of making the harbor waters of a "drinking water" standard of purity, sterilization for the great bulk of the New York sewage need never be seriously considered. For some of the outlying areas where there are shell fish layings or bathing beaches I anticipate a resort to sterilization.

Miscellaneous Procedures

From time to time attention is attracted by claims for unusual efficiency or economy, or both, resulting from the employment of special types of strainers or other clarifying agents, or the use of oxidizing procedures resulting from the use of new chemicals or of new applications of electricity.

Presumably such claims will be heard of at intervals in the future, and it may be that some of them will produce more effect for a given cost than could now be attained.

I do not believe, however, that the business aspects of the New York problem will ever be materially modified by improvements in methods or devices which may become available.

As time advances a clearer understanding will be obtained as to just what is needed in certain of the subdivisions, and the progressive installation of any project as large as the New York sewage disposal problem will give opportunity to adopt in the designs the current improvements, which, as above stated, will in all probability relate to minor details rather than to underlying principles.

The Bell Falls Hydro-Electric Development on the Rouge River

By L. A. Herdt, D.Sc., F.R.S.C.

THE Hawkesbury Electric Light and Power Company have lately completed and put in operation their new hydro-electric development at the Bell Falls, on the Rouge River, about eleven miles from Calumet, Que. This development was started in the summer of 1913, but a considerable part of the work has been carried out since last July. The company's original power house of about 1,500 horse-power is also situated on the Rouge River, about six miles nearer to its confluence with the Ottawa River. The original transmission line supplies 3-phase current at 10,000 volts to the villages of Calumet and Grenville on the Quebec shore of the Ottawa River, and to the towns of Hawkesbury and Vankleek Hill in Ontario. The demand for industrial power in Hawkesbury was increasing, and the new power house at Bell Falls and the new transmission lines to Hawkesbury will bring about 5,000 horse-power to the market.

At the Bell Falls the course of the Rouge River encounters a natural obstacle formed by a spur of a hill running directly across the valley and narrowing the river channel to a gorge at the end of the spur. The river passes through the gorge over a natural fall of about forty feet, and at the head of this fall a dam has been built raising the water in the upper bay to 60 ft. above the level of the lower bay. This general configuration of the river course is somewhat common in the Laurentian district, perhaps the best known case occurring on the St. Maurice River, at Shawinigan Falls.

Power house.

Head works of concrete, consisting of rack chambers with stop log checks, have been constructed on the upper bay, and a square tunnel 100 ft. long and of 17 square feet section has been driven through the rock spur, conducting the water to the fore bay and wheel pits on the hillside of the lower bay. The wheel pits, which are three in number, are open pits of reinforced concrete, with individual rack chambers, gates, and stop log checks. Two reinforced concrete wing walls running back to the tunnel entrance on the hillside form the fore bay. In each pit is placed a twin runner horizontal shaft turbine with shaft extending through the wall of the wheel pit into the generator room and directly connected to 3-phase, 60-cycle, 2,000 k.v.a. alternators developing current at 2,300 volts at 277 r.p.m.

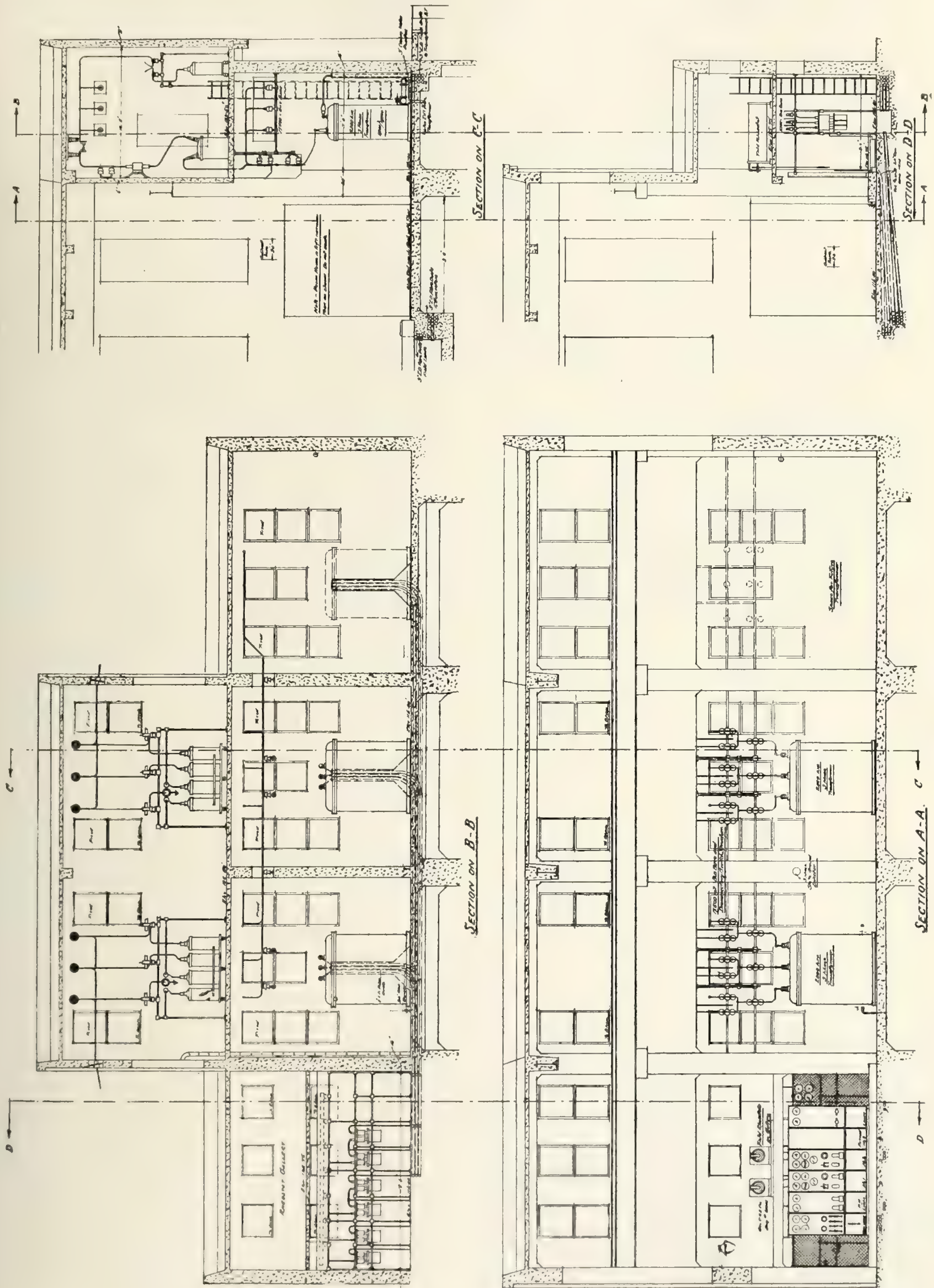
Head works on upper bay.

The draft tubes are constructed of reinforced concrete, and the generator floor is constructed above them.

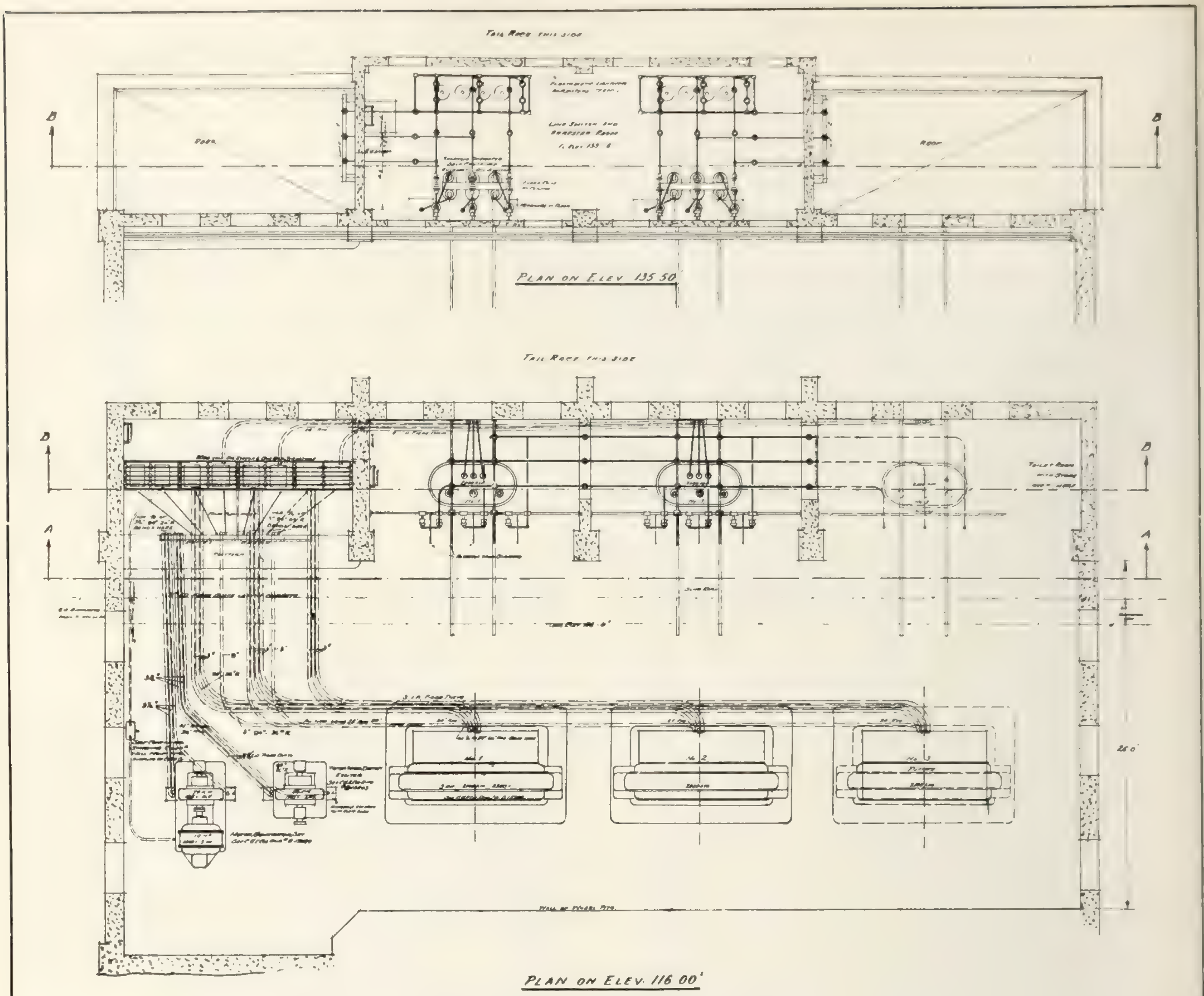
The generator floor is constructed over the tail race for individual transformer chambers and switchboard chambers. Each chamber, which is about half the height of the generator room, is separated by a concrete barrier, but is open to the generator room. Thus transformers may be run out of their chambers on to the generator floor and handled on the travelling crane in the generator room. Slide rails embedded in the floor are provided in each transformer chamber for this purpose. Each transformer chamber is opposite the corresponding generator, and the switchboard chamber is at one end of the room, opposite the exciter bay. The generator field rheostats are located on a small mezzanine gallery above the switchboard. The line chamber is constructed above the two middle transformer chambers, and extends up to the level of the generator room roof. One line is brought in at each end of this chamber.

Fore bay and power house.

Two exciters are provided, each capable of exciting



Sectional elevations of power house.



Plan showing general construction of power house.

the three alternators. One is driven by induction motor from the 2,300 volt bus bars; the other has an enclosed water wheel directly connected to it, taking water through an iron pipe penstock from the wheel pit of unit No. 1. The exciters operate at 720 and 600 r.p.m., respectively.

Laying submarine cable.

All 2,300-volt bus bars and switches are in the switchboard chamber, and are mounted on an iron pipe framework. The oil switches and circuit-breakers are mechanically operated from the panel board at the front of the chamber, which faces directly on to the generator floor.

The transformers, which are 3-phase, oil insulated, water cooled, and of 2,000 k.v.a. output, raise the voltage from the generator voltage of 2,300 volts to 17,500 volts for transmission to Hawkesbury, a distance of about fourteen miles. The 17,500-volt bus bar is located on the ceiling of the transformer compartments, and the two line oil circuit-breakers are immediately above it in the line chamber. These circuit-breakers are electrically operated by solenoid from the panel board on the generator floor. Two sets of electrolytic lightning arresters are provided, one for each line, and are installed in the line chamber.

The high voltage bus bar is merely a transfer bus and line; transformer and generator form a direct switching unit, the third generator and transformer being connected only through the transfer bus.

The low voltage switching arrangement is somewhat similar, the bus bar being used only for transfer and synchronizing and for local service 2,300-volt supply.

Transmission Line.—The transmission line consists of two 17,500-volt, 3-phase circuits, of 7-strand aluminium cable equivalent to No. 1 B. S. copper, carried on a single wooden-pole line.

Near Calumet the line crosses the Ottawa River by means of two submarine cables, one connected to each circuit, but capable of carrying all the power over one line in case of emergency. This river crossing has several features of special interest. The cables are directly connected to the transmission line, without the interposition of transformers. They are lead sheathed and armored with galvanized steel wire and insulated with paper for a working pressure of 22,000 volts. Outdoor type terminals without any housing are used at the ends of the cables, which are continuous, without joint from shore to shore, each being 2,100 ft. long. The shipping weight of each drum was 38,000 lbs., and the drums were 9 ft. 6 ins. in diameter.

One cable was laid at a time. The cable drum was mounted on bearings in a crib on a scow, and payed out as the scow was towed across the river. The laying of one of these cables is illustrated.

The transmission line will feed direct into the substation at Hawkesbury, and there the power will be distributed partly at the line voltage and also through step down transformers over the 10,000-volt lines of the Hawkesbury Electric Light and Power Company in multiple with No. 1 power house.

The power house, dam and transmission line were constructed by the Hawkesbury Electric Light and Power Company, by day labor. The power house switching equipment was supplied and installed by the Canadian Westinghouse Company. Generators, transformers and exciters were supplied and installed by the Canadian General Electric Company. Water-wheels were supplied and erected by Canadian Allis-Chalmers, Limited. The submarine cable was supplied and installed by the Canadian British Insulated Cable Company.

The Consulting Hydraulic Engineer on the work was Mr. Wm. Kennedy, Jr., of Montreal, and Mr. L. A. Herdt, D.Sc., was the Consulting Electrical Engineer, assisted by Mr. E. Godfrey Burr, Electrical Engineer, Montreal.

The Value of An Absorption Test for Wood Blocks[*]

When municipal engineers were considering the advisability of laying treated wood block pavements some twelve or fourteen years ago, it was uncertain as to just what should be the requirements of the specifications. It was well known from previous experience that the blocks should be treated, but just what the nature of the preservative should be and how much should be used were not well known.

At that time it was proposed to treat the blocks with what was known as the creo-resinate process, that is, the preservative should be composed of one part of creosote oil and one part of resin. The theory of the resin in the preservative was that the creosote oil, being a volatile substance, would naturally lose its value under climatic conditions, but that the resin would keep it in the blocks so that its preservative properties would be more enduring. It was felt that it was necessary to prevent the blocks from decaying and also to treat them so that they should not absorb so much water as to make them swell and cause the pavement to bulge during a wet spell. Neither should they shrink too much in dry, hot weather, so that they would become loose. Twenty pounds of preservative was decided upon, but just how to be sure that the blocks were treated with this amount was a question, it not being deemed practicable to have inspection at the plant. It was finally decided that as the weight of long leaf yellow pine (the wood that was to be used) was known to be about 42 pounds per cubic foot, if the blocks would sink in water they had been sufficiently treated, and that requirement was specified.

The test for expansion was not so easy. After careful consideration it was decided to require an absorption test of the blocks. This test provided that after having been dried in a kiln at a temperature of 100 deg. F. for 24 hours and then immersed in water for an additional 24 hours, the blocks should not gain in weight more than 3 per cent. during immersion. Pavements were laid under this specification in 1903 and 1904; on one street with a specially prepared oil preservative that did not contain any resin. All these blocks conformed to the requirements as to weight and absorption. These pavements have been in use 10 and 11 years, without any expansion joint, and have required almost no attention on account of instability of the blocks.

In certain cases where pavements were not laid under the supervision of the city and the absorption test was not applied, the pavements did expand to a very considerable extent. The writer knows of one instance where blocks were laid that were supposed to conform to the absorption test but did not, and had been condemned, and these blocks expanded materially and had to be taken up and replaced.

The city of New York is the only municipality known to the writer where the absorption test is required, and it is also the only city, to his knowledge, where an expansion joint is not used. Some five or six years ago the specifications were changed so that an oil having a specific gravity of 1.10 to 1.12 was used without any resin. The absorption test was retained, however, but the percentage was increased to 3½ for long leaf yellow pine. No trouble has occurred on account of bulging, even where expansion joints were not used.

The writer firmly believes that with a heavy oil treatment and a specification requiring an absorption test, as given above, satisfactory results can be obtained without an expansion joint.

Some believe that if a less amount of oil is used there will be less bleeding of the pavement, although by the use of an expansion joint practically the same results can be obtained. Whether the reduction of 3 or 4 pounds of preservative per cubic foot will materially reduce the bleeding of the pavement when first laid is uncertain so far as present experience goes.

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[*] Paper before the American Association for the Advancement of Science by Geo. W. Tillson, Consulting Engineer, New York City.

It is not desirable to use expansion joints crosswise of the street, and if the use of an expansion joint along the curb is relied upon to take up an excessive expansion of the pavement due to a light treatment and consequent great absorption, it is possible that bulging will occur lengthwise of the street when it would not occur crosswise.

The Borough of Manhattan, New York City, in the 1914 specifications, has decreased the amount of treatment from 20 pounds to 18 pounds and has permitted an absorption of 5 per cent. with no expansion joint; a bituminous joint filler is used, however. Just how pavements laid under these specifications will work out in practice has not been determined at the present time. But assuming that an expansion joint along the curb will take care of all thrust in any direction on account of expansion, with a treatment of less than 20 pounds per cubic foot and a 5 or 6 per cent. absorption (although this is not admitted by the writer), the engineering question would remain whether it would be desirable to have the lesser treatment with the expansion joint rather than the greater treatment without it. As the great majority of the wood pavements of this country of long leaf yellow pine are more apt to fail through some other agency than that of traffic, the writer feels that a little extra expense in the treating of the blocks will be justified in the long run. He realizes, of course, that where the traffic is heavy or moderately heavy, so that the blocks are liable to wear out in a reasonable length of time, so much of the preservative per cubic foot is not required as upon light traffic streets.

He feels, therefore, that from the experience of Brooklyn particularly a stringent absorption test is of great value and that the expense incurred to make the blocks meet it is justifiable. He appreciates fully the inconvenience of making the absorption test, and the expense the contractors are liable to be put to if the blocks, after being delivered on the street, do not meet this requirement. The test, however, may be made at the plant where the blocks are treated, and if made by an authorized inspector of the municipality and the blocks used soon after, he believes that this trouble would to a great extent be obviated.

The Advantages of a Cement-Sand Bed for Wood-Block Paving

By Clark R. Mandigo*

PORTLAND cement should be mixed with the sand used as a bedding course in the laying of creosoted wood-block paving, for the following reasons:

1. Along streets with car lines the rise and fall of the rail and the jar of passing cars will cause the shifting of a plain sand cushion. Where water gets in around the rail this rise and fall seems to have a pumping action, forcing the water and sand considerable distances.

2. When service cuts are made a dry, loose sand cushion may run for some distance, especially on a grade, due to the blows of cutting the foundation. This displacement of the cushion may be slight, and pass unnoticed when the cut is repaved. Any settlement of a portion of the blocks causes unnecessary wear.

3. When any bulging of the blocks or other accident occurs which makes necessary the relaying of a portion of the blocks the work is more easily and accurately done where the bed for the blocks retains its original position and is smooth and hard.

4. A cement-sand bed is good insurance against the displacement of the surface due to water getting underneath the blocks on a grade and shifting a loose sand course. This would apply to springs and leaky service pipes or mains as well as to storm water.

5. Wood blocks are usually laid with a soft filler in the joints. The jamming action of heavily loaded vehicles may easily displace some of the blocks, the sand cushion shifting and retaining the displacement, and the pavement gradually becoming slightly uneven.

The writer has seen the results of the failure of plain sand cushion in all of the cases cited. Fortunately, wood blocks accommodate themselves readily to slight displacements and broom down, wearing smooth with the surrounding pavement. To insure long life and even wear, however, it is absolutely essential that the wood blocks should be placed and maintained to as true and even a grade and crown as it is possible to get. If the surface is kept true there is practically no wear on the blocks.

The term "cushion," where cement is used, is, of course, a misnomer; it should be called leveling course or laying bed: the blocks themselves are a cushion. Probably the best way to lay wood blocks is in asphaltic cement mopped on an absolutely smooth floated concrete foundation. Such a base, however, is very difficult to obtain in the present state of municipal contracting, and a cement-sand bedding course accomplishes very nearly the same results except for the waterproofing of the under side of the blocks.

The cement and sand should be mixed dry in the proportions of about 1 to 4, spread on the foundation, templated, and the blocks set and rolled in the same manner as where a plain sand cushion is used. This allows the blocks to be bedded properly before the cement has set, and avoids any difficulty in placing them on a wet mortar. After the blocks are rolled, the water necessary for the cement can be added by sprinkling the surface of the pavement, or enough moisture would probably be absorbed from the concrete foundation to set the cement. The bedding course should be only thick enough to level up the unevenness in the base, and with ordinary care in laying the concrete foundation ½ in. should be sufficient. The increase in cost of such a cement-sand course over plain sand is so slight, while the advantages gained are so important to the wearing surface, that a continuance of the use of plain sand as a bed for wood-block paving appears to be poor economy.—Engineering Record.

Notable Examples of Bascule Lift Bridges

HEREWITH we illustrate five bridges of the bascule lift type in use in Canada. This class of movable span is specially adapted to certain sites and various forms have been developed to suit local requirements.

The Cross Wall Bridge at Princess Louise Dock, Quebec, Que., is an 88-ft. span, carrying a single-track railway. The bascule is of the Strauss type with a concrete counterweight, and was built in 1911. The moving leaf weighs 110 tons, and the whole steel structure, including machinery, weighs 168 tons. The structure visible in the lower left-hand corner of the

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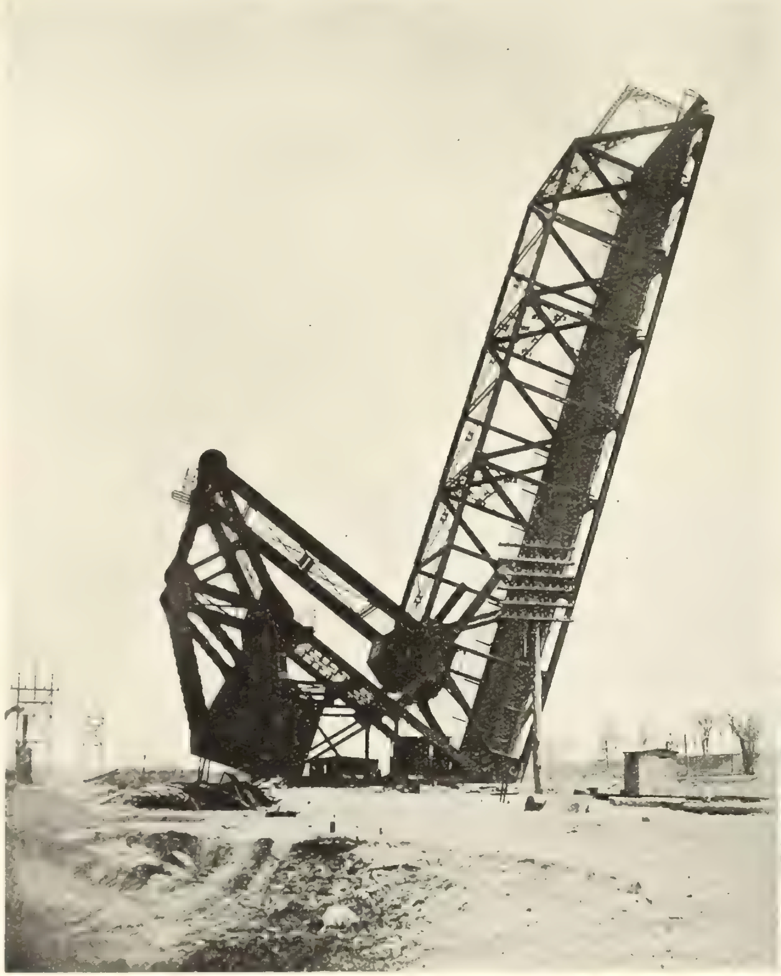
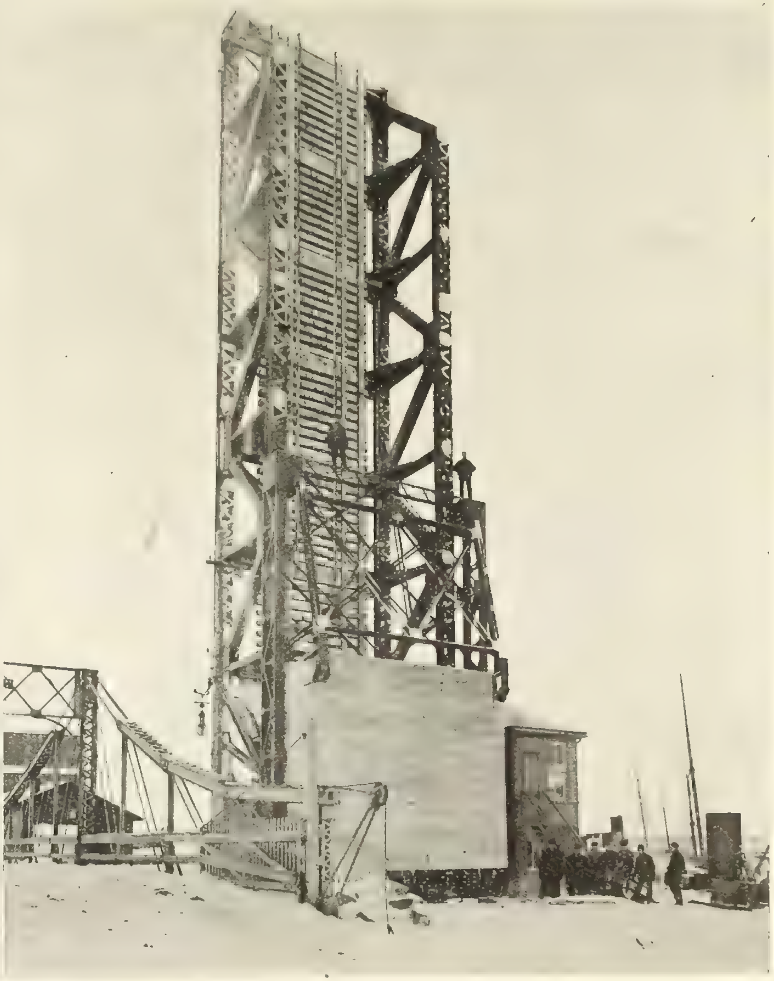
* Assistant City Engineer, Kansas City, Mo.

Bascule Bridges in Quebec

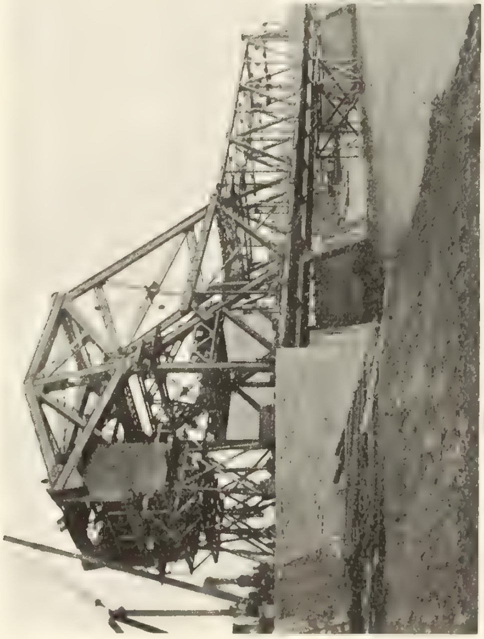


The Rockfield bascule.

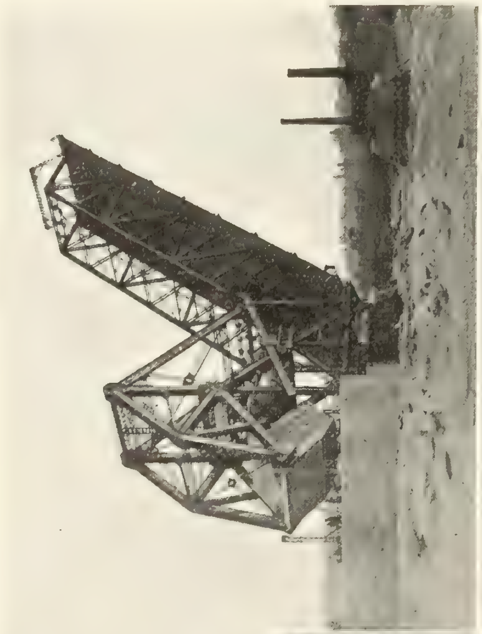


Bascule at Princess Louise Dock.

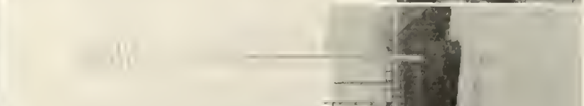
Bascule Bridges of East and West



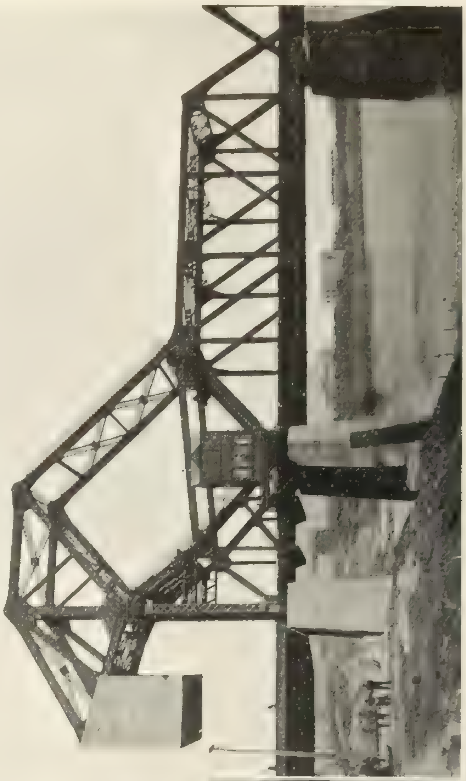
Dorchester Bridge, St. Charles River, Quebec.



The Dorchester Bridge open.



Main Street Bascule, Vancouver.



Bascule over Red River, Winnipeg.

cut is an old "rectractile" draw-span of 120 ft., built in 1888.

The Rockfield Bascule was built in 1913 for the Dominion Government and crosses the Lachine Canal about five miles west of Montreal. It, too, is of the Strauss type with the counterweight rotating on a separate trunnion. The span is 165 ft. long and carries street-car tracks and regular traffic on a thirty-foot roadway. Sidewalks on brackets are provided. The moving leaf weighs 207 tons and the weight of the whole structure, exclusive of machinery, is 417 tons. The concrete counterweight weighs about 940 tons.

The Main Street Bascule at Vancouver, B. C., was built to the design of Messrs. Waddell & Harrington, and is of the simple trunnion type. The span has a length of 127 ft. 10½ ins., and carries a roadway 42 ft. wide with two sidewalks outside. The total weight of the steel in this bridge is 398 tons, of which 327 tons is included in the moving steel.

The Red River Bascule on the National Transcontinental Railroad at Winnipeg was built in 1909 and carries a double track designed to accommodate heavy loading. This Strauss type lift span has a length of 132 ft. The moving steel in the leaf weighs 301 tons, exclusive of the operating machinery. The counterweight tower weighs 213 tons and the counterweight truss 199 tons.

Another Strauss type bascule highway span is the Dorchester Bascule over the St. Charles River at Quebec, Que., which carries a 26-ft. roadway with two sidewalks on brackets. The span is 148 ft. 9 ins. long, and weighs complete 388 tons, of which the channel span makes up 140 tons.

All the bascule lift bridges illustrated herewith were built by the Dominion Bridge Company, who lent the illustrations.

Repairing and Patching Concrete

Wet Method.—The surface of the old concrete is thoroughly roughened, cleaned, and drenched with water, and covered with a cement grout. Then the new concrete is mixed to a sloppy consistency and applied, being held in place till set by forms, as required.

From the reports received, it appears that many successes and many failures have followed this method. Where it has been successful, that result probably has been due to painstaking care and expense having been employed in the preliminary cleaning and thorough wetting of the old concrete surfaces before the new concrete is applied.

Moderately Dry Method.—The surface of the old concrete is thoroughly roughened, cleaned, and drenched with water, and powdered with cement or painted with cement grout, after which the new concrete is applied and thoroughly tamped against the old surface. Generally, such patches are kept moist by sprinkling them with water for several days.

The same comment applies here as to the wet method.

Dowel Method.—This is a modification of the two preceding methods, and is generally used for other than horizontal surfaces, although it may be applied to the latter. The new concrete may have any consistency to meet the particular conditions or the ideas of the engineer in charge; but usually a fairly wet concrete is used. This method includes drilling holes and setting dowels into the old concrete, with projecting ends to engage into the new concrete. Sometimes steel bars or metal fabric are connected to these dowels to further ensure permanency of the pitch.

This method can be made uniformly successful, but cannot be applied always. Where any considerable mass of new concrete is to be connected to old concrete, this is the only safe method to pursue.

Wedge Method.—This method includes the cutting out of defective concrete in such a manner as to undercut the surrounding good concrete so that the new concrete will be held in place, when set, by the shape of the binding edges of the old concrete.

The difficulty of under-cutting concrete so as to secure such edges is too great to make this method applicable in ordinary cases; and, except where a considerable depth of new concrete is to be put in, such under-cutting could not be done successfully, as concrete cannot be cut so as to leave sharp, clean edges.

Cleaning With Steam.—This is a method of cleaning the surfaces of old concrete preparatory to putting on a patch of new, or of cleaning the top of a rough concrete floor before applying the "finish coat." The surface of the old concrete is brushed as clean as possible with stiff brushes, and then gone over at least twice with a steam jet. An ordinary piece of ½-in. gas pipe makes a very satisfactory jet nozzle. This short length of pipe is connected to a steam hose so that it can be moved about readily. The steam is supplied by the boilers of the mixer or hoisting engines. The steam will clean and heat the concrete surface, leaving it perfectly dry; so it is important to drench the surface thoroughly with water after cleaning with steam. In cold weather it is found advantageous to use hot water. Immediately after the surface is thoroughly cleaned and drenched, the new concrete is applied.

Excellent result have followed the use of this method of cleaning; but it is essential that the surface of the old concrete be thoroughly drenched with water after using the steam jet, otherwise the new concrete will not adhere to the old.

Cleaning with Acid.—This method includes the washing of the surface of the old concrete with a solution of hydrochloric (muriatic) acid (one part acid to two parts water), after which the surface must be washed carefully and thoroughly to remove any free acid.

This is a very commonly applied method of cleaning old concrete surfaces preparatory to placing new concrete against them, and is considered by many the only safe treatment to use, especially in cases where a "finish coat" is to be put on after the concrete base is set.

An interior loading platform, to prevent street obstruction by trucks or freight, will be a novel feature of the building soon to be erected for the Eagle Pencil Company in New York City. With the exception of the main entrance hall and an inclosed storage space, the entire first floor will be utilized as a loading platform and driveway, allowing convenient movement of trucks. The platform will be accessible from two streets.

The present movement for the inauguration of better estimating methods is gaining headway fast, and the time is not far distant when the contractor will refuse to give gratuitous bids to owners, who, at their own discretion, may or may not build, or who may never have intended to build.

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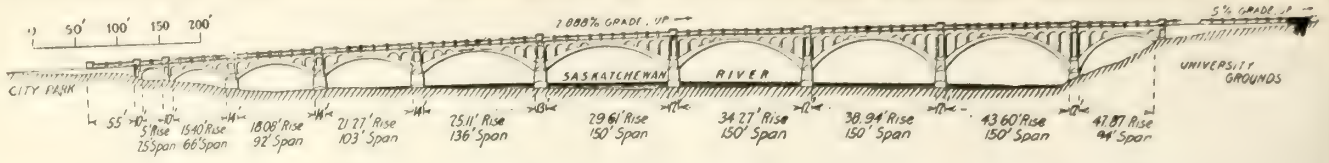
[*] Data collected by the Committee on Masonry of the American Railway Engineering Association.



Elevation of the new concrete bridge.

Concrete Plant Used on Saskatoon Bridge

In the articles describing the design and construction of the new concrete bridge at Saskatoon, Sask., appearing in The Contract Record of February 10th and March 17th, 1915, mention was made of the successful use of a pneumatic concrete mixer employed by the contractors for placing concrete in the arch rings. Further details of the performances of this mixer are now available, and are given below.

The mixer used on this work was a No. 2 size, owned and leased by the Pneumatic Concrete Placing Company of Canada, Limited, of Montreal, sole agents for the McMichael Patents in Canada. The mixer has a rated cubic capacity of ½ cu. yd. of mixed concrete to a batch. It consists essentially of a cone-shaped steel shell terminating at the bottom in an 8-inch elbow with flanged connection to the pipe line through which the concrete is conveyed to place. The dry materials are charged into the mixer through an air-tight intake valve from a measuring hopper above, Water is admitted with the dry materials, and air is admitted at two points—at the top, just below the intake valve, and at the bottom, at the back of the elbow. In operating the mixer, the dry aggregate and cement, with the necessary amount of water, are admitted from the hopper, the intake valve is closed, and air under a pressure of about 80 lbs. is admitted at top and bottom, forcing the materials through the pipe at a high velocity. The materials and water are intermingled to a certain extent when leaving the measuring hopper, and the final mixing is accomplished while travelling in the pipe line, due to the materials travelling at different velocities. There is, of course, a considerable difference in the sizes, surfaces, and specific gravities of the various materials in a batch, and the presence of air aids in maintaining a variable friction in the inner and outer portions of the cross-section of the conveying pipe. The presence of a volume of air larger than that of the batch aids in reducing the frictional resistance of the pipe line, as the solids are bouyed to a large extent by the excess air. Actual movement of the batch is accomplished by the impact of the air forced in at the elbow, assisted by the expansion of the compressed air from the mixer to the end of the pipe line.

The mixer used at Saskatoon was located on the side hill at one end of the bridge, enabling the contractors to handle materials to the mixer by gravity from the top of the hill. The materials used consisted of graded gravel with stone, mostly under 2-inch size. The gravel was hauled by teams, and unloaded on a stock pile from which the bins were filled by team scrapers. The aggregate was drawn from the bins into a measuring hopper, where the cement was added. For concreting the arch rings the pipe line was laid on a trestle along the middle of the bridge carried on the centring, the axis of the pipe being about on the level of the floor line. The pipe line ended in a discharge box, from which portable chutes were laid to the point of final deposit. This mixing plant was used to place all concrete after August, 1914, until cold weather set in, in December, and established a record for Western Canada for yardage of concrete placed. In the first two weeks during which the plant was operated this mixer placed over 2,600 cubic yards, and a single arch ring, aggregating 500 cubic yards, was concreted in 17½ hours of operating time. With the delivery end of the pipe line 375 feet from the mixer an average of fifty batches an hour was maintained, and at 1,000 feet thirty-five batches an hour was the output over a lengthy running period. The speed of operation depends upon the efficiency of the men operating the mixer, the amount of air available, and the length of the pipe line, assuming that the materials can be supplied to the mixer at the rate required. On the particular plant in question one man was able to attend to the charging of each batch, including adding the water, and one man attended to all the operations necessary to mix and convey the batch to place and, as stated above, an average of fifty batches an hour was maintained over a number of days.

For this work the contractors used an 8-inch, lap-welded, steel delivery pipe, with cast steel elbows. This size pipe line will require about one cubic foot of free air to a lineal foot of horizontal pipe line. Air was furnished from two Ingersoll-Rand straight line compressors driven by two 75 h.p. Canadian Westinghouse motors. At full load the compressors delivered each about 400 cu. ft. of free air a minute at 80 lbs. Near the mixer was placed a steel receiver of 125 cu. ft. capacity, acting as a reservoir, under a working pressure of 110 lbs. to a sq. in. It has been found that only about 5,000 cu. yds. of concrete can be placed through spiral-riveted and lock-joint steel pipe before leakage develops, but that English seamless steam pipe will deliver 10,000 to 15,000 cu. yds.; while the life of oil well casing may be measured by the delivery of 18,000 to 20,000 cu. yds. of concrete. Cast iron, 90-deg. bends should have a radius of not less than 5 feet, and generally will need replacing after passing about 2,000 cu. yds. Long radius cast steel elbows will deliver from 15,000 to 20,000 cu. yds., depending upon the aggregate.

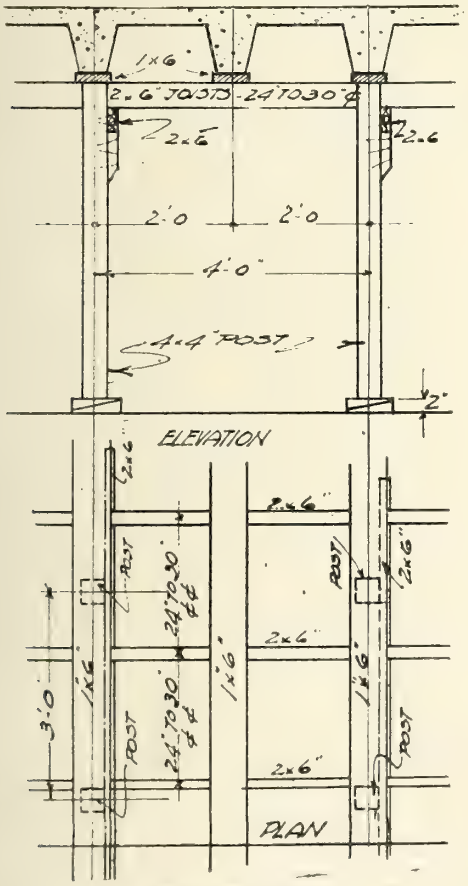
The cost of such a system of mixing and placing concrete is made up of (1) the cost of compressor air plant, including power and air lines, and installation; (2) installation of pneumatic mixer and pipe line, including renewal of discharge pipe line, if any; (3) royalty for the use of the system; (4) operation of entire plant.

The first two items, of course, will vary according to conditions and locality; the third—the rental or royalty—is usually set at 20 cents for each cubic yard of concrete placed; the fourth item is also variable, but the direct labor charge for mixing and placing should seldom exceed 5 or 10 cents for every cubic yard of concrete.

This type of mixer has found its best use in the placing of concrete lining for tunnels, but has been used successfully on many types of construction work, particularly in placing concrete in river bridge piers. It is in use elsewhere in Canada on the walls and dam of the 40,000,000-gallon reservoir for the Montreal Water and Power Company, on the lining for the Mount Royal Tunnel, Montreal, and for the power development at Niagara Falls, and has been selected for use in placing all the concrete for the new trunk sewer tunnels in Vancouver. The contractors on the bridge at Saskatoon, which is being erected by the province of Saskatchewan and the city of Saskatoon, are Messrs. R. J. Lecky & Company, Limited, of Regina.

Details of Shoring for Large Concrete Building*

THE accompanying illustration shows a very interesting feature in connection with the concrete work on the Garden Court Apartments in Detroit in the winter of 1914-1915. The building is about 107 ft. wide, 185 ft. long, and contains two wings, each measuring about 40 ft. by 40 ft. It is 100 ft. high and has about 147,000 sq. ft. of floor surface. The concrete frame-work was designed along the lines of standard practice. The floors are of Floredome construction as shown in the sketch.



Sketch of shoring.

Form work for the entire building was erected complete before any stripping was done, no shoring whatever being re-used. The reason for doing this was the installation of one floor every 5 days, and as an extra precaution, due to the fact that the concrete roof was poured two weeks before any stripping was begun.

There were 14,000 pieces of 4-in. x 4-in. studs, 10 ft. long, used for shoring, being spaced from 3 ft. to 4 ft. on centres. To the uprights were nailed 2-in. x 6-in. planks, which supported 2-in. x 6-in. joists, spaced from 2 ft. to 2 ft. 6 in. on centres. The joists supported 1-in. x 6-in. planks spaced 2 ft. on centres, which in turn supported the steel Floredomes used as centring for the joist floor construction.

The particular type of metal forms ordered for the job was found to be unsatisfactory for the large columns in the basement and the ground floor. For columns 26 in. x 26 in. in size and up, the metal forms bulged badly at the bottom, due to the hydrostatic pressure of the wet concrete and to the frail construction of the forms. They were soon discarded after pouring several columns, and not even tried for the smaller columns in the upper storeys.

The concrete work was protected from freezing by enclosing the building with canvas and keeping salamanders burning for three days after placing the concrete. It cost about $10 a day to operate these salamanders on each floor.

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*Concrete-Cement Age.

Plaster Lining of Irrigation Canals

By Calvin Casteel

(concluded from page 617)

For small ditches whose side slopes do not exceed 4 ft. in length ordinary plaster lath has been used with very satisfactory results; for larger ditches 1 x 2-in. material serves the purpose. Four men are employed on the straight edges; these straight edges are made of 2 x 4-in., 12 ft. long, planed smooth on all four sides. One man works on each end of the straight edge. The first time it is stroked with the straight edge the flat way, and for finishing it is run on edge to remove any excess material that may be left, on account of the straight edge springing when flat; a straight edge is worked on each slope. Behind the straight edge crew, from five to ten men are employed in shovelling out the excess material and levelling up the bottom. Back of these four more men are employed, one on each berm and two in the bottom. The two men on the bank are employed in cutting the berm level with the top of the strips which have been set with the template. The men running the straight edge should mark the top of the berm with the straight edge by pressing it back from the top of the strips, and thus making a mark that these shovellers can follow. These shovellers should use long-handled, square-pointed shovels, and the berm should be cut level for a distance of not less than 10 ins. The two shovellers in the bottom are employed in finishing the bottom ready for concrete. They also use square-pointed shovels, to make the square corners at the junction of the bottom with the side slopes.

Aggregate

The Okanogan Project is very fortunate in having an abundance of aggregate. A long haul is hardly ever required, as aggregate of a good quality can generally be found near the work. Seldom is a haul of a mile required.

Pit run has in general been used, and everything has been screened out that will not pass a one-inch screen. This leaves generally a preponderance of sand, and is just what is wanted for plaster lining. Tests as to the volume of voids in the aggregate are often made, and the amount of cement necessary has varied from 1:4½ to 1:5½, generally running about 1 to 5.

Equipment.—The mixing on the Okanogan Project has been done with a Northwestern ¼-yd. power mixer, equipped with a self-loading bucket and a rotary pump for supplying water.

It has been found economy, however, to have the pump run by a small engine of 1½ h.p., separate from the mixer. The pump and engine are both mounted on a small platform, which could be moved from one set-up to another by hand, unless a long move was made, in which case it was hauled in a wagon.

The pump was placed at the upper end of the section to be lined, where the water supply is, and a 1¼-in. supply pipe run from the pump to the mixer. The length of this pipe varied from 300 to 400 ft., depending on the length of the set-up and location of the mixer, the mixer being set up as near the centre of the section as the local conditions would permit.

This method of furnishing the supply of water for mixing has been found far better than the old plan of working pumps with the engine on the mixer, as in this case it was necessary to run the supply pipe in the bottom of the ditch to the mixer, because it was impossible to get the joints tight enough so that the pump would life the water from the ditch, at a distance of from 300 to 400 ft. When the pipe was laid in the bottom of the ditch it was something of a handicap for the plastering crew working on that end of the section.

The platform for the mixer is set on solid ground whenever possible, and in a good many cases where the lower bank was narrow a temporary bridge was built across the canal and the mixer set on this. The minimum size for a mixer platform is 16 x 16 ft., and in most cases this was increased to 16 ft. by 20 ft., with the mixer set cross-wise on one end. The platform is nailed down in all cases to make it solid, so as to facilitate the movement of the wheelers to and from the discharge door of the mixer.

The time of discharging the batch of mixed concrete from the mixer with the wheelbarrow is one of the limiting conditions to the maximum output, and special effort has been made to eliminate all delays at this point. There should be an incoming and an outgoing runway in each direction, to avoid confusion at the mixer. The mixing and placing is handled by one sub-foreman, who must be a very energetic fellow, and who can see to the details which aid or hinder the total day's work of the crew. He must also be ready at all times to lend a hand on anything that may come up and need immediate attention.

The runways used for the wheelers were 1½ x 12-in. and 1½ x 10-in. planks, 16 ft. long; the latter were just as convenient as the former, and seemed to last longer without splitting at the ends, besides being easier to handle and cheaper in first cost. Two complete sets of mixer platforms and running boards were used, the set not in use being moved ahead for the next set-up, and were all in place when the mixer was ready to be moved. Where there is a low bank, and the concrete lining comes near the top, the running boards should be set out at least three feet from the edge of the lining, where it is possible. They can be set closer when necessary, but if they are set closer the wheelbarrows bother the plasterers when working near the top of the lining, and this should be avoided if possible. Wherever it can be done, the bank should be levelled off for the full length of the set-up on the outside of the running boards, so as to provide a return runway for the empty wheelbarrows. If it is not economical to do this, frequent turnouts should be made so that the empty wheelbarrows can avoid the loaded ones without losing any time.

The platforms for dumping the concrete on, at the point where it is used, are 6 x 6 ft., set on trestles 2 ft. high. One-inch boards and 2 x 4-in. are used in making these platforms and trestles. In the case of small ditches, the platforms are laid across the ditch from bank to bank, while in medium sized ditches, of the right height, one trestle is used in line with the ditch, and the other end of the platform is put on the bank. These platforms are moved ten feet at a time.

Mixing.—The cement and gravel are placed in the loading bucket together, and the water is started running with the mixing drum as the bucket starts up to discharge. In this way all the batch is mixed to the same consistency. The mixing should be continued for one minute and sufficient water applied to make it wet enough to spread easily. The man who runs the engine operates the loading bucket and the water supply. The operator signals the man at the discharge door when the batch is ready. Two or three men are required to load the bucket with gravel, and one to handle the cement. It takes two and a half minutes to mix and unload a batch.

Wheeling.—A good concrete wheelbarrow, having a guaranteed capacity of 3 cubic feet of wet concrete, is needed for this work. The number of wheelers required depends upon the length of the set-up, and height of runways above tables. Under average conditions, with a 100-ft. set-up, ten wheelers can keep the mixer running to full capacity.

Plastering

The tables or plastering for a 600-ft. set-up, which is the best length to use under average conditions, are located as follows: Table No. 1 is at the upper end of the section; Table No. 2, 140 ft. below No. 1; Table No. 3, 300 ft. below No. 2; Table No. 4, 460 ft. below No. 3. All four crews work in the same direction, which keeps the total average length of haul the same until the section is finished. The difference in the length of sections for the two middle and the two end crews is made on account of the concrete being harder to plaster and finish after it has been hauled the greater distance. When concrete is hauled from 400 to 500 ft. it is necessary to remix it after it is dumped on the tables, on account of its settling while being hauled. On this account the length of set-up should not exceed 700 ft., which makes the average haul 350 ft.

A placing crew consists of one shoveller and two plasterers, which in small ditches is reduced to a shoveller and one plasterer. The shoveller uses a No. 2 scoop, and the plasterers have a wooden float, a plasterer's trowel, a template or straight edge, and a jointer. The shoveller places the concrete on the bottom and slopes, where the plasterers can spread it out evenly with their float and then finish it up with their trowels. Every 10 ft. an expansion joint is made; several kinds of joints and jointers have been tried. The easiest and most satisfactory joint was made with a common plaster lath sharpened on one edge. To make the joint, this lath is pressed into the concrete to a depth of 1 in. and then removed, and the crease made is stroked lightly with a trowel to smooth down any rough edges that might be made when the lath is removed. The plasterers use a straight edge on the berm and on the side slopes to gauge the thickness of the lining, and in case the ditch bank is so high that the plasterers cannot work from the bottom, a ladder is used which is laid flat on the slope, and has a straight edge on one side the right thickness, to which he lays the concrete. In all cases, when the plasterer moves his ladder or template, to which he is laying the concrete, he strokes the edge of the finished concrete with his trowel and gives it a bevel. If this is not done a small crack will appear where the union is made.

The plasterers work opposite each other, and take turns in finishing the bottom. In some cases, where it is convenient, the wheelers dump the concrete on the slope to the plasterer on the side next to the runways; this saves shovelling and enables the shoveller to give more time to placing the concrete for the other plasterer. Both corners, where the side slopes join the bottom and the berm, are rounded slightly, which gives a much better appearance. A good plasterer on this work should plaster from 5 to 6 cu. yds. of concrete in an eight-hour day, providing he is furnished with material all the time, making from 1,080 to 1,296 sq. ft. Two men have done 16 cu. yds. in one day, making for one man 1,628 sq. ft.

Water Supply

The water supply is kept up with the mixer by building sack dams at the lower end of the section just completed and letting the water down for each move as it is made. A sack dam was found most convenient, as the water could be easily controlled when letting it out. On account of the concrete being green, it is necessary to let it in slowly at first, until it has reached the next dam and started to back up, when the flow can be increased. As the dam cannot be built until the upper section is finished, it is necessary to take precautions to have everything in readiness beforehand, as for average moves the water supply is the last thing ready, and with a pay-roll of from $10 to $12 an hour any delay of the whole crew on this account may increase the cost of a move from 50 to 100 per cent.

When the pump was attached to the mixer, from 300 to 400 ft. from the water supply, it was necessary to lay the pipe in the bottom of the canal, so as to have a gravity flow up to within 30 ft. of the pump, as a rotary pump would not deliver a sufficient supply, on account of air leaks at joints, and it also required some time to get it started, which increased the cost of moving considerably. With a separate pump and engine, the pipe can be laid on the bank out of the way of the plasterers, and can be moved in about half of the time, without damaging any lining in taking it apart at the union and getting it up on the bank.

The supply pipe has a union every 100 ft., so that it can be uncoupled for moving from one set-up to the next. Where the canal is comparatively straight the 400 ft. can be moved in one piece by placing a man at each 20-ft. joint. This is much quicker and cheaper when it can be done, and does not require any more men, as there are always plenty of men available for this work.

A track man is employed, whose duty it is to see that the runways are kept in order, and who also assists the placing crew when making a move with their table. The runway board, from the runway to the table, always comes down from the slide away from the placing crew, so that the wheelbarrow load is always dumped on the side nearest to the shoveller. Two or three boys are employed to keep the sides and bottom of the ditches well sprinkled with a sprinkling can, just ahead of the plastering crews, as the surface is apt to get dry before the concrete is laid.

A roustabout team is employed, to haul away boards and platforms ahead to the next set-up, and also as one of the teams in moving the mixer. One of the teams employed in hauling aggregate is used when needed in moving the mixer from one set-up to the next. One man is employed in keeping wet the concrete that has already been laid; this is wet from four to six times a day for a week after it has been laid. The cost of this work is lessened, and better results obtained, by keeping the water backed up in these sections as high as possible with sack dams. This should not be done, however, for at least 24 hours after the lining is placed, as there is danger of the thin lining being broken up if a high head of water is backed upon it before the final set takes place. In case the weather should be cold, and there is any likelihood of frost, it is well to cover the concrete before the day is finished with 2 or 3 ins. of earth, which, under ordinary circumstances, will protect it until it can withstand the frost.

Efficiency of the Lining

One of the essential factors that has determined the cost of the lining on the Okanogan Project is the cost of the cement on the work, which until last spring was $6 a barrel, but we are now getting it for $3 a barrel. With this comparatively cheap cement, the lining has been done for about $12.50 a cubic yard, as against $18 to $22 when the work first started. The cheapest lining cost $11 a cubic yard, and the costliest $13.90, being respectively 5.1 cents and 6.4 cents a square foot. The cheaper lining has not all been due to the price of cement: a constant improvement in the methods of doing the work has aided greatly in reducing this cost.

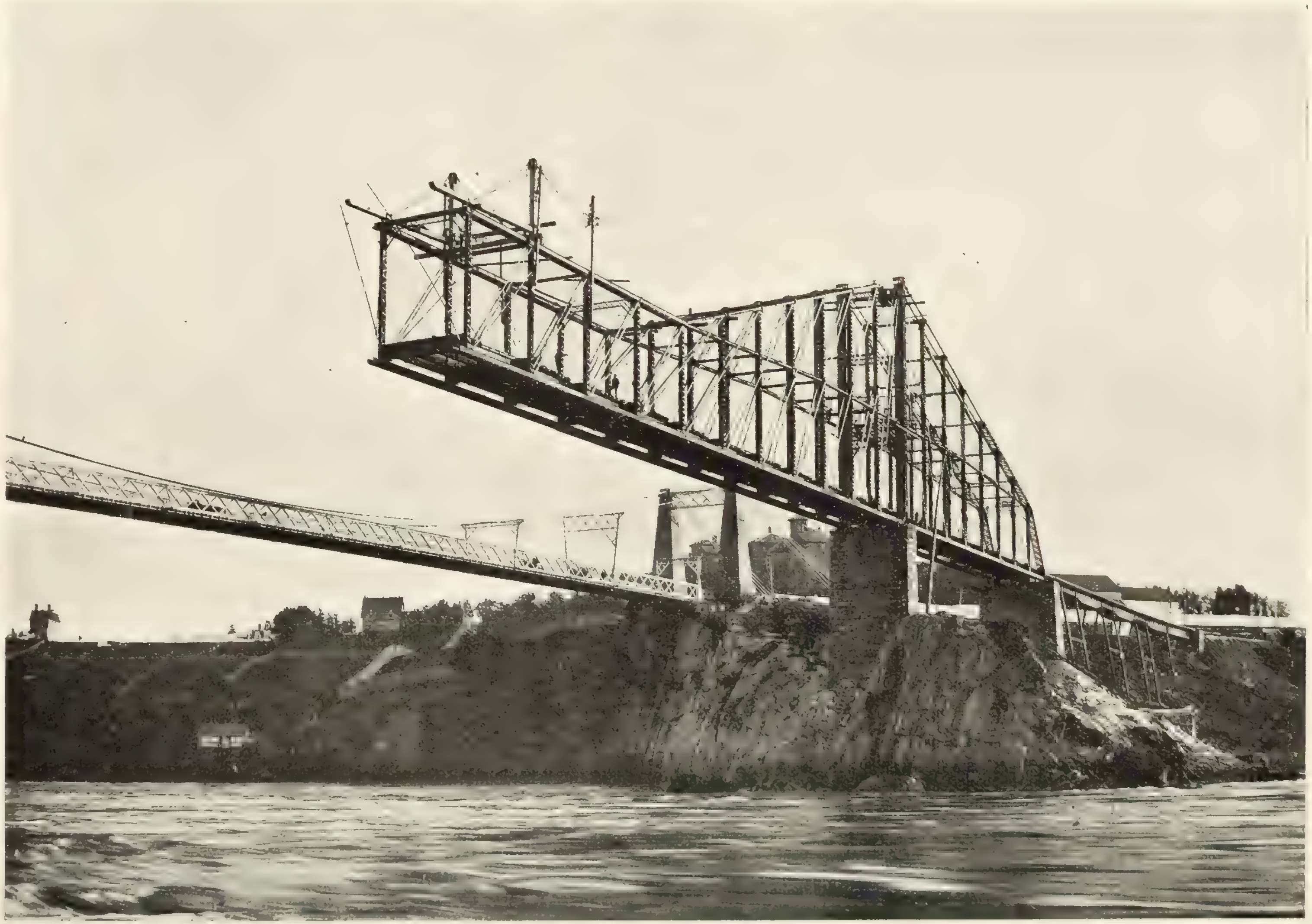
Determining Voids in Fills by Puddling

DO not place too much trust in a fill which was partially made a generation or two ago. The older portion may be the more treacherous. Perhaps trees and brush were used in making the original fill. If they have decayed, the fill is in a honeycombed condition and likely to give way. The best method of locating voids is by puddling. Enclose your sub-grade with temporary earth dikes 2 ft. higher than the sub-grade and divide it into compartments by similar cross dikes. Fill the compartments with water, one at a time, and weakness, if any, will shortly appear. The usual method of relying on a roller for compacting a fill is not nearly so efficacious. In my experience, not more than 10 per cent. of the fills can be properly compacted with a roller alone.—Extract from a paper before the Northwestern Road Congress by James M. McCleary.

Moulds for concrete newels, finials, rails, balusters, spindles, balls, caps and bases for piers, etc., should be so constructed that they can be removed piece by piece without injuring the casting. Their strength and rigidity must be ample to withstand tamping and other strains without distortion.

Broomed surfaces for concrete roads are not so common now as they were. Brooming merely weakens the surface and presents a series of projections which greatly increase abrasion.

The St. John Cantilever Bridge



Constructing the cantilever over the St. John River.

The description of the new highway arch bridge over the St. John River, published in a recent issue, recalls the construction of the Cantilever Bridge at St. John, N.B., which was one of the Dominion Bridge Company's earliest contracts. This bridge spans the famous Reversible Falls of the St. John River, and serves as the only railway entrance to the town of St. John from the west. The above view illustrates the construction in 1884, and shows the light top chord traveller building out the cantilever arm, the shore arms having been erected on falsework by a high wooden outside traveller. The bridge was built for a special company with the purpose of joining up the Canadian Pacific on the west side to the Intercolonial on the east. The principal dimensions are as follows: length of bridge proper, 813 feet, with channel span 477 feet; length, including approach trestle, 1,220 feet; width, 20 feet centres; maximum height, 80 feet over pier; total weight, 4,465 tons.

Expansion in Concrete Sidewalks

CONCRETE sidewalks may be generally divided into two classes with reference to expansion troubles—those in which there is a strip of earth between sidewalk and curb, except at street intersections, where the sidewalk pavement is continued to the curbs (as shown on the accompanying plan); and those in which the concrete sidewalk covers the entire surface from the buildings on one side to the curb on the other, says the Municipal Journal. In the latter construction there will almost invariably be a durable pavement on concrete foundation extending across the roadway from curb to curb, while such pavement may or may not exist in the other case.

Concrete expands by an appreciable amount under the effects of either heat or moisture, late investigations indicating that moisture has even more expansive effect than heat. This tendency to expansion is very powerful, and yet not irresistible, as is seen from the fact that a continuous mass of concrete extending from building line to building line across the street could not expand without moving the walls of the building, which apparently it does not do. In such cases there is, of course, an internal compressive stress produced by the pressure of the structures which prevent the expansion. In the first class of pavements referred to above, the sidewalk tends to expand, and the longitudinal expansion is resisted only by the curb across the end of the sidewalk. If this is not sufficiently strong and well anchored to resist the force of expansion, it is pushed outward. When the sidewalk contracts again, the tendency is for each block to contract individually, widening the joints between blocks, which fill with dirt, small stones, etc., which tend to render permanent this widening of the joint. When the pavement next expands, therefore, it pushes the end section a little further, and so by small increments the end of the pavement creeps gradually further and further from its original position. It would seem, therefore, that either the curb at the end of the sidewalk must be sufficiently strong and well anchored to resist the thrust of expansion, or it must be allowed to move, with serious detriment to its usefulness and appearance. There is a third alternative, however, that of designing the construction that the expansion may expand itself in some other less objectionable direction. Such an idea is indicated in the sketch, Fig. 2, in which the pavement is cut into two wedge-shaped blocks adjacent to the intersection. The two heavy blocks at the corner furnishing considerable resistance, which is greatly assisted by the foundation of the roadway pavement, these two wedge-shaped pieces marked c c will have the tendency to move inward from the curb, which movement is resisted only by the soil, the resistance of which would presumably be considerably less than that offered by the corner pieces. Weak points in this construction would be the acute angles caused by the diagonals, but this point can be strengthened by bevelling the edge of the pavement so as to give the pointed end of the block a triangular rather than a knife-edge section. This bevelling of the edge would also assist somewhat in permitting the blocks to move as intended, by causing the earth to slide up the inclined edge. This would, of course, throw the wedge-shaped blocks slightly out of line, but this would not be nearly as objectionable as the same amount of movement in the curbs. A strip of thin metal left in the diagonal joints would facilitate this movement.

Another method of treating the problem would be to carry the sidewalk pavement continuously to the face of the curb, as shown in the lower cross-section in the sketch, resting it upon the concrete or other gutter material, which at this point is carried back under the curb; placing a joint of about a sixteenth of an inch of tar between the under side of the sidewalk concrete and the gutter, which tends both to make this joint watertight and also to permit sliding under temperature expansion and contraction. Reinforcing rods would then be carried back through several of the sidewalk sections, being especially well anchored near the curb line so that movement of the sidewalk due to expansion should not be permanent. With such construction, the face of the sidewalk in line with the curb would move very little out of line. Should this movement become objectionable in amount, the concrete could be cut back and refaced at comparatively small expense.

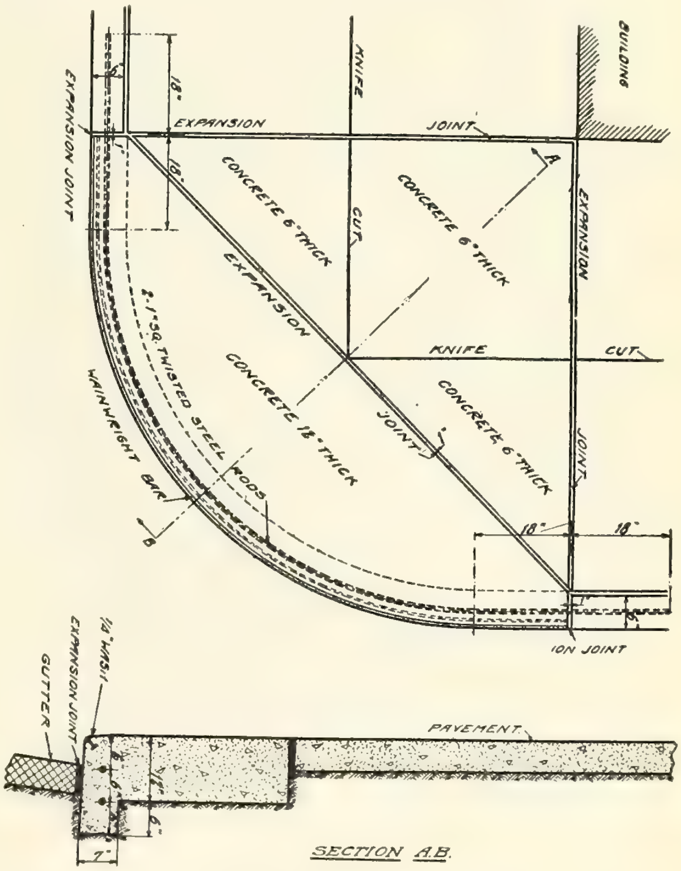


Fig. 1.—A successful type of concrete corner.

Probably the simplest method of attempting to overcome all of this expansion trouble is to use expansion joints. These have, we understand, given satisfactory service in some cities, but owing to the comparatively weak resistance to expansion offered by a light curb we anticipate that under many conditions it will not prove a sure remedy.

The second case, that of a sidewalk continuous from building to curb, is the most difficult to treat, because here no motion is possible without overthrowing the curb, except such as is provided for by open joints, whether filled with expansion material or not. The force exerted against the upper edge of a curb by such a sidewalk and a similar force exerted by a concrete roadway foundation at about mid-depth, can be successfully resisted only by the strongest curbing, such as heavy granite or a very heavy concrete. In some cities this difficulty has been met by carrying the sidewalk concrete across the top of the curb, but the joint between the sidewalk concrete and the top of the curb is almost sure to weather or otherwise break into an open joint which is disfiguring and very apt to increase until the edge of the sidewalk becomes very ragged. What seems to us a more satisfactory plan has been adopted in a number of cases in both large cities and small towns. This is the construction shown in the lower section of the accompanying drawing and already suggested for the intersection of narrow sidewalk and curb. It consists in not using any curb at all, strictly speaking, but in finishing off the edge of the sidewalk so that it takes the place of the curb, this edge resting upon the concrete or other gutter as shown. (This assumes that concrete curb would be used and is sufficiently durable for this location. Should granite or other more substantial material be desired, the ordinary construction would of course be used). Here also there would be a slight tendency to progressive motion due to dirt sifting into the joints when the pavement contracts, but this motion would not be considerable nor its results serious. If it is desired to avoid it, however, reinforcing rods could be used, tied back into the inner block. They could be anchored either by bending the forward end of the reinforcement, by using an anchor plate, or by anchoring the rod in a plate used for protecting the edge of the curb. In some cities the entire face of the curb, in streets where traffic is heavy, is protected by a steel plate extending from the gutter to the top of the curb, the reinforcing rods being provided with heads which are countersunk in the face of this plate. The strength of the reinforcement should be sufficient to overcome the friction of the sidewalk sliding on the cinders beneath it and on the gutter as it contracts to its original position. The cost of this reinforcement would be less than that of providing a substantial curb as in ordinary construction.

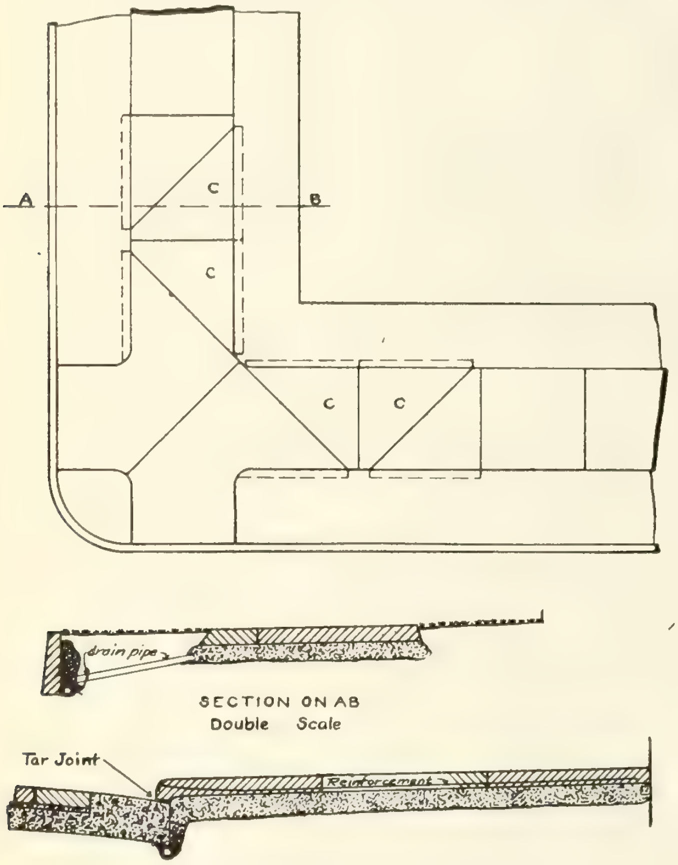


Fig. 2.—Proposed construction of concrete sidewalk.

Curbs are often thrown forward by the expansion of freezing ground. This can be prevented by ensuring that the ground behind the top half of the curb is kept drained. Where the ground is naturally sandy or gravelly, and there is any outlet for the ground water close to the surface, there is generally no trouble of this kind. Where the ground is of clay formation, however, it is desirable to place gravel, broken stone, clean cinders or some other material which will readily allow water to pass through it, from the base of the curb up to within an inch or two of the surface, placing on top just enough soil to provide for the roots of sod. It is desirable to connect this curb drainage, either continuously by a layer of gravel or at intervals of from ten to thirty feet by small pipe, with the porous foundation provided under the sidewalk pavement to drain the latter. This construction will permit the water to drain to the bottom of the curb, but unless it is removed from there this will be of little benefit. Where the grade is fairly steep, all that is ordinarily necessary is to provide an outlet for this blind drainage system into the sewer catchbasins or whatever other outlet is available. It is safer, however, especially where such outlets are very infrequent, or where the grade is quite flat, to place a small tile drain behind the curb at its base in order to remove the water which seeps to this point.

Another concrete record of 322 cu. yds. placed in eight hours by a ½-cu. yd. mixer was made at Balboa, Canal Zone, on April 19, according to the Canal Record, in concreting the south wall of dry dock No. 1. The mixer was one of four, normally operated in pairs. Its mate was out of order on this day, and both crews, numbering twenty-nine men and one sub-foreman, were doubled on one mixer. The total labor cost was $34.87, or 10.8 cents per cu. yd. Labor on this work, however, is only paid 13 cents an hour. Delays amounted to one hour and forty-five minutes, so that the concrete placed per hour of working time was over 51 cu. yds. measured in the form. The mixer turned out seventy-nine batches per hour while running, as each batch in place averaged slightly over 0.65 cu. yd. It is estimated that during this running time each of the eighteen men engaged in wheeling aggregate to the mixer must have handled 147 lbs. of gravel per minute.

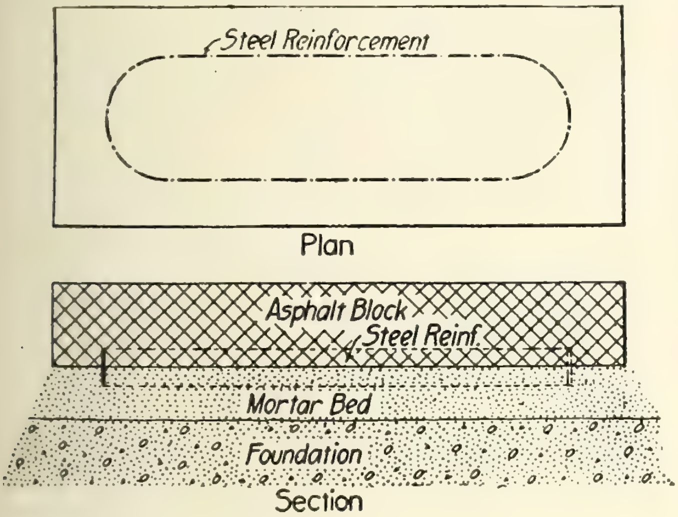
Layers of concrete should not be tapered off, but be built with square ends. When from any cause it becomes impracticable to complete a layer, a plank of convenient width should be secured to the form, against which the concrete should be rammed, thus making a vertical joint.

The City Treasurer of Vancouver, B. C., will feel the effect of the reduction of travel over the street car lines resulting from the growth of the jitney bus traffic. It is said that the city's revenue from the street car lines will be decreased this year by about $30,000.

Anchor Block for Asphalt Block Pavement

ASPHALT paving blocks are made 12 ins. long, 5 ins. wide and 2 ins., 2½ ins. and 3 ins. thick. They are a mixture of trap rock, limestone dust and asphaltic cement moulded under a pressure of 240 tons. In reinforcing macadam roads the old surface is brought to grade by scarifying and thorough rolling; soft spots are filled with concrete and over all is spread about 1 in. of Portland cement mortar, 1:4 mixture, just wet enough to be readily struck true to line. The blocks are bedded in the fresh mortar, the layers standing upon the blocks already laid. If the pavement does not extend from curb to curb, the edge of the pavement is secured by concrete edging or a border of anchor blocks. By thus adapting an old-tried and proven material to a new use, many miles of heavily-travelled macadam highways can be converted at moderate cost into permanent highways which otherwise would be a source of endless expense and annoyance.

Where firm old macadam foundation is not available or where the macadam is too thin to be serviceable, a foundation of Portland cement concrete is laid ranging from 4 ins. to 6 ins. thick. When blocks are laid upon a concrete foundation they are bedded in fresh mortar about ½ in. thick and the surface of the finished pavement is covered with a thin layer of clean sharp sand. The sand is broomed into the joints as thoroughly as possible and the surplus left upon the surface for thirty days, during which time traffic works the sand into the joints. Asphalt blocks are malleable, and the action of traffic irons the top edges of the joints together so that in a few weeks the joints have almost disappeared and the surface is smooth and water-tight.



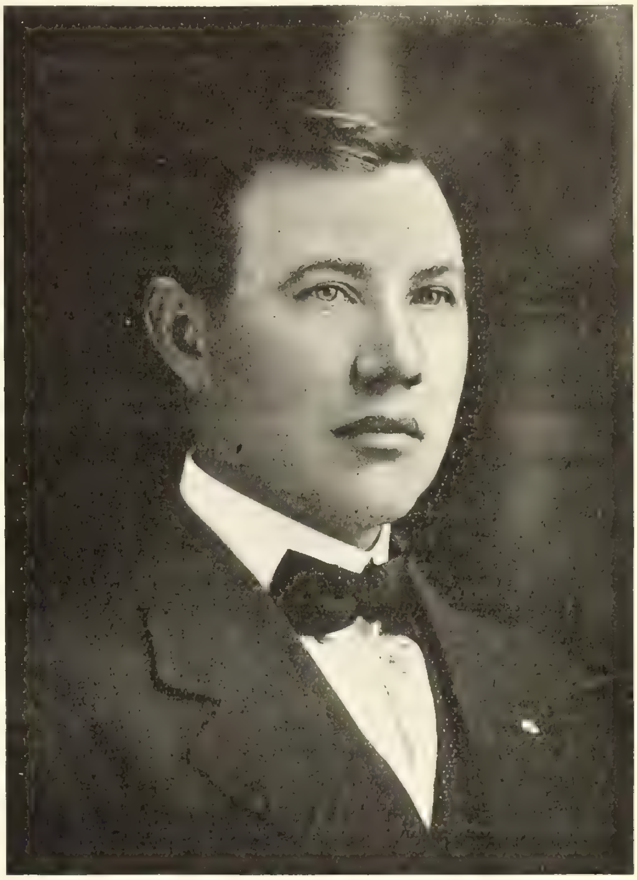
Detail of anchor block.

As motor truck traffic increased, it was found that the severe vibrations and pushing action of these vehicles had a tendency to crowd the asphalt blocks out of line and in extreme cases to distort the blocks. To remedy this trouble, an anchor block was devised as illustrated in the sketch. A steel strip 1 in. wide, shaped like an elongated letter O, is forced ½ in. into the block and projects ½ in. into the mortar. The anchor blocks are prepared at the plant and a row of them is laid across the street at intervals as required. This has effectually stopped movement of the blocks. The anchor blocks have been successfully used as borders, thus dispensing with expensive concrete edging.

This description is abstracted from a paper on Asphalt Block Pavement in "Cornell Civil Engineer," by Geo. P. Hemstreet.

Personal Mention

MR. W. H. Carter, whom we present to our readers this week, is President of that well-known Winnipeg contracting firm, The Carter-Halls-Aldinger Company. He was born at Bismarck, Illinois, in 1874, and received a good grounding in building construction in the school of practical experience. In 1900 he became Superintendent of Construction for the William Grace Company, of Chicago, for which firm he went to Winnipeg as branch manager in 1903. Four years later he organized the firm of which he is now President. Mr. Carter was President of the Winnipeg Builders' Exchange in 1910 and 1911, and again in 1914.



Courtesy of International Press

Mr. W. H. Carter, of Winnipeg.

Mr. R. H. Balfour, of the Montreal Light, Heat and Power Company, has been appointed Chief Engineer of the Montreal Electrical Commission.

Prof. A. A. Stoughton, of the University of Manitoba, attended a meeting of the Town Planning Commission in Detroit last week as the representative of the city of Winnipeg.

Mr. C. Ross Cameron, Sales Manager of the William Hamilton Company, Limited, Peterborough, Ont., resigned his position recently to go to the front as commander of the machine gun battery, Third Contingent. Mr. Cameron had been with the William Hamilton Company for about fourteen years, and during most of this time he was associated with the 57th Battalion. Mr. G. R. Munro, Chief Engineer, has assumed the duties of Sales Manager in addition to those of his own department.

Mr. Arthur Putnam Scott, who has been appointed head of the metallurgical department of the Snyder Electric Furnace Company of Chicago, is a Nova Scotian, and graduated from McGill University, Montreal, with the degree of B.A. and the Logan gold medal for natural sciences in 1896 and with the degree of B.Sc. and the British Association medal in chemistry and metallurgy in 1898. A year later he became assistant chemist with the Dominion Iron & Steel Company of Sydney, N. S., and was appointed chief chemist and assistant metallurgist of that company in 1904. He resigned this post in 1908 to enter the service of the General Electric Company, Schenectady, N. Y., as representative metallurgist at the Brackenridge plant of the Allegheny Steel Company. In 1911 he was recalled to Sydney as metallurgist and superintendent of the steel department of the Dominion Iron & Steel Company. Until recently Mr. Scott has been engaged in consulting work, with headquarters in Montreal.

The death is reported of Thomas L. Delaney, President of the Anderson & Delaney Contracting Company, Limited, Montreal.

Mr. C. F. Dibblee, C. E., died at Woodstock, N. B., recently. The late Mr. Dibblee had been in poor health for some time, and had not been engaged in active work since the completion of the Transcontinental Railway, with which he was connected.

Mainly Constructional

East and West *From Coast to Coast*

The Norwood Engineering Company, Cowansville, Que., have commenced work on the erection of a new factory for the manufacture of shells.

The National Iron Works, Limited, have been granted a certificate of incorporation at Vancouver, B. C. The capital stock of the company is $25,000.

The Kingston Brick and Tile Company at Seeley's Bay, Ont., who have been turning out large quantities of drain tile, are about to commence manufacturing brick.

The Oranova Brick Manufacturing Company have started work at Welland, Ont. The site of their plant has a frontage of a quarter of a mile on the M. C. R., which railway will run a switch into the works. The company will operate on the co-operative plan.

At Kincardine, Ont., the Hunter Bridge and Boiler Company have received an order for 25,000 4.7 shells. The order is required to be finished in October, and is worth about $150,000. It will require the working of day and night shifts to get the work out on time.

After numerous delays, there is a probability of the Montreal new building code receiving final consideration by the Council. The compilation of the code has been in preparation for several years. It has been modified and rearranged, and is now ready for the Council's deliberations.

It is understood that work will commence on the Canadian Northern Railway, close to the Manchester sub-division, near Calgary, Alta. A large contractor's outfit is now encamped close to the C. N. R. station, ready to commence work on the grading of the Macleod branch of that railway.

The firm of F. R. Wilford & Company, Limited, has been incorporated at Lindsay, Ont., with a capital stock of $50,000. The incorporators are F. R. Wilford, M. M. Wilford, G. H. Hopkins, G. E. Donaldson, and A. E. Gregory, all of Lindsay. The firm will carry on a general construction business.

Special machinery and plant is being installed in the factory of the St. Thomas Metallic Grave Vault Company, at St. Thomas, Ont., for the manufacture of 25,000 shells of the 18-lb. high explosive variety. The contract was awarded recently, and operations will start as soon as the machinery is in place.

Work has been started on the laying of the outfall of the North-West Sewer System, Victoria, B. C. A single length of 36-inch steel pressure pipe 132 feet long is to be floated out in one section and sunk. A diver is to be employed in constructing a concrete platform upon which to lay the steel pipe.

The annual statement of the Dominion Steel Corporation was an agreeable surprise to the shareholders. The company earned all its fixed charges and the corporation preferred dividends, and had a balance of $345,000 applicable to subsidiary preferred issues. The net earnings of the corporation and its constituent companies were $3,571,058.98.

Designs for three new bridges have been submitted to the Winnipeg City Council, drawn by Mr. Paul Schioler in collaboration with Prof. A. A. Stoughton, of Manitoba University. The proposed new bridges are to be constructed on Main Street at a cost of $191,276, on Maryland Street at a cost of $141,680, and on Arlington Street at a cost of $126,379.

St. Lawrence Machinery, Limited, is the name of a company incorporated recently to carry on the business of machinists and mechanical, electrical and civil engineers at Montreal, Que. The incorporators of the company, which has a capital stock of $50,000, are C. F. Smith, E. E. Cummings, Jr., H. J. Trihey, P. Berovitch, and E. Lafontaine, all of Montreal.

The Spartan Machine Company, Limited, has been incorporated at Montreal, Que., for the purpose of manufacturing and dealing in all kinds of railway, mining and builders' and contractors' supplies and materials. The capital stock of the company, the incorporators of which are E. E. Howard, J. DeWitt, H. C. McNeil, W. H. Howard, and H. E. A. Rose, is $50,000.

Four members of the Civic Engineering Department, Vancouver, B. C., have been working long hours preparing plans for the repair of the Connaught Bridge, several spans of which were destroyed by the recent fire. It has been necessary to make new copies of the original plans, and a scheme is being arranged for the better protection of the viaduct in case of another outbreak of fire.

The City Architect's Department, Toronto, are preparing a heating by-law the chief object of which will be to see that all heating apparatus are installed properly. A considerable amount of damage is done each year by the blowing up of boilers due to faulty installation, and the by-law is intended to make it possible for the city authorities to see that all valves in hot water systems are fitted properly, so as to guard against the danger of explosions.

At Hamilton, Ont., the City Council have adopted the recommendation of the Board of Control regarding an agreement with the Canadian Cartridge Company, which provides for the sale of two acres of land to the company at $4,500 an acre. The company will start work at once on the construction of buildings at a cost of between $30,000 and $40,000, and when the plant is in full operation it will give employment to some two hundred men, working day and night shifts.

Hastings County Marble Company, Limited, is the name of a firm incorporated recently at Toronto for the purpose of mining and quarrying marble, stone, and other materials. The company will acquire the McGrath property in the township of Marmora, Ont., and the water power known as the Ellis Falls in the township of Belmont. The capital stock of the company is $100,000, and the Provisional Directors are G. B. Balfour, M. Crabtree, J. Parker, J. M. Duff, and L. H. Page, all of Toronto.

The Canadian Locomotive Works Company, Kingston, Ont., have just concluded a new contract with the Canadian Shell Committee for the British Government which will keep the works busy for the next year. The company have been making shells since last November, and they are now able to produce 700 finished shells a day. The new contract calls for shells for 4.5 guns, and also for 60-pounders, and it is expected that three hundred men will be needed in addition to the four hundred now employed.

The Quebec Public Utilities Commission have ruled that the financing of schemes is outside their jurisdiction. The question arose when the Montreal Electric Commission submitted plans for the construction of further underground conduits. Two companies interested raised an objection to the work on the ground that financial conditions were adverse. The Commission, however, declared that they had nothing to do with this, their authority being limited to the approval, modification, or arrangement of the plans.

Considering the adverse conditions, the earnings of the Peter Lyall & Sons Construction Company, Limited, Montreal, for the year ending March 31st last were satisfactory. They totalled $209,677 net, compared with $230,405 last year and $258,697 in 1913. Bond interest absorbs $71,984, the sinking fund $40,000, and the preference dividend $91,000, leaving a balance of $6,693, which, with the previous balance brought forward, gives a total of $82,830. The company have secured an order for the manufacture of 4.5 howitzer shells.

The contract for the construction of the second unit of the main channel jetty on the Fraser River, at Steveston, B. C., has been let to the Marsh Hutton Powers Company, Limited, the contract price being in the neighborhood of $400,000. The contract calls for the completion of this second unit, which is 7,100 feet in length, in twelve months from the date of the contract, and the contractors will start work almost immediately. The jetty will be of brush and rock construction, and about five hundred men will be employed on the work.

The members of the Vancouver branch of the Canadian Society of Civil Engineers have organized an engineering corps which will carry on every type of field work practised by engineers in actual warfare. Mr. R. F. Hayward, General Manager of the Western Canada Power Company, is the Commander of the corps, and the members will erect a 100-yard rifle range, with trenches, land mines, and replicas of various offensive and defensive works, on a tract of land obtained from the Canadian Pacific Railway Company southwest of Shaughnessy Heights.

At a recent meeting of the Saskatoon Builders' Exchange in the Board of Trade offices, the committee appointed to meet the delegates from the Trades and Labor Council, representing the plumbers, carpenters and painters, with respect to rates of wages for the present season, reported the result of their interview. The committee felt that until there was some prospect of building operations opening up it was impossible to come to any definite agreement. They decided, however, to report back to the Builders' Exchange, and the chairman of the committee was instructed to bring in a written report at the next meeting of the Exchange, outlining the different grievances of the various branches of the building trades, more particularly with regard to the bricklayers (who were not represented at the interview), and also to suggest remedies.

One hundred thousand dollars' worth of constructional material of all descriptions, from cement mixers and diving outfits to chisels and hammers, has been purchased from Canadian manufacturers and distributors by the Canadian War Purchasing Committee during the last few weeks. Mr. W. Shives Fisher, a member of the firm of Emerson & Fisher, of St. John, N. B., represented the Commission, and has closed the last of the orders.

All the material secured is to be used in connection with the operations of the Canadian Overseas Railway Construction Corps, which was organized some time ago by the C. P. R., and which has been stationed at St. John, N. B., since February 15th. The Corps has now acquired its full strength of slightly over 500 officers and men, and is under the supervision of Col. Ramsay.

Inspectors are at present supervising the manufacture of the purchases and it is expected that all material will arrive at St. John on the specified date.

The work the corps will engage in at the front, although not yet definitely known, is expected to be that of constructing strategic railway or other bridges. Motor cars for the quick transportation of supplies from the base to the front have been purchased, and everything for which there is likely to be the remotest need has been secured. All the officers of the Corps are experienced engineers, about half having been in the employ of the Canadian Pacific Railway when hostilities commenced. The privates have also had actual experience in the building of bridges and other construction work.

The Board of Directors of the National Paving Brick Manufacturers' Association at their quarterly meeting held in Cleveland, Ohio, May 27th, affirmed arrangements tentatively made for holding its annual meeting October 11-12 at Dayton, Ohio. The annual meeting of the American Society of Municipal Improvements will be held during this week. This arrangement will enable the members of the National Paving Brick Manufacturers' Association to attend the meeting of the American Society.

Montreal's Paving Difficulties

The city of Montreal is having a considerable amount of trouble with the tenders for cement and asphalt sidewalks and the supply of asphalt. When the tenders for laying cement sidewalks were opened, we understand that it was found that the F. J. Jago Company, Limited, had made a deposit of $20,000, which was $32.92 short of the necessary ten per cent. on the price of their tender. The City Attorney thereupon ruled that it was out of order, and the Board of Control awarded a contract to another firm, whose tender was the second lowest on the list, but $7,712 higher than that of the F. J. Jago Company. Further inquiries elicited the fact that three other contractors who had made bids were short in their deposits. One was only a cent short, another $1, and a third $8.33. These tenders were also put aside, the net result being that the city will pay about $40,000 additional by adhering to the strict letter of the law. The city will get about two-thirds of this work, being the lowest tenderers for certain sections, while Henault & Hefferman have been awarded a considerable amount of work.

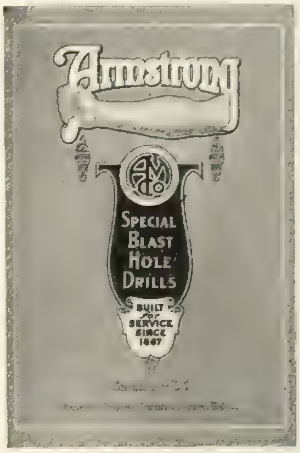
With regard to asphalt sidewalks, the Controllers have accepted the tender of the Sicily Asphalt Company for laying mastic asphalt sidewalks at $1.98 per yard, the city tender being 50 cents a yard higher. Controller Ainey, who favors day labor, dissented, and expressed surprise that the city prices were so high, particularly as the city had been able to underbid contractors formerly. Mr. Mercier, the Assistant Engineer, explained that previously the city had tendered too low in some instances, while this year he had added 10 per cent. for maintenance. A statement is to be prepared showing the cases where the prices quoted by the city have been insufficient.

Objection has been taken in the Council to a recommendation by the Board of Control to award a contract to the Simplex Paving Company for re-surfacing certain streets at 40 to 45 cents a yard without calling tenders. The Controllers base their award on the urgency of the work and on the fact that the city cannot do the work at the price quoted.

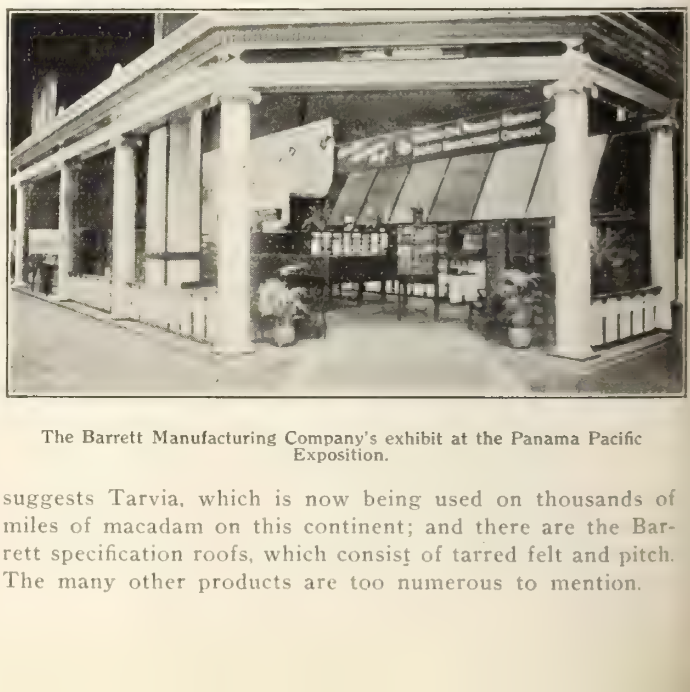
There has been keen competition for the supply of asphalt, and the decision of the Board of Control to award the contract to the Aztec Oil and Asphalt Refining Company has led to litigation. The bids submitted were: Texaco made by the Texas Company, $14.27 per ton; Aztec Company, $16.45; Asphalt and Supply Company, $15.75 (or $14.25 delivered in tank cars). The Warner Quinlan Asphalt Company and the Imperial Oil Company also sent in bids. On the Aztec Company expressing willingness to reduce the price to $15.50 delivered at the city yards, the Controllers decided to award them the contract for one year, with a recommendation that an additional contract for nine years, or a lesser period, be made with the same company at $15.50 a ton, provided the company agreed to construct a refinery in Montreal. The city is not required to buy the by-products of the company, and a deposit of $50,000 must be placed with the City Treasurer guaranteeing the company's fulfilment of the obligations. Controller Hebert recommended the Aztec tender on the ground that the material had given satisfaction in New York and that Montreal had the opportunity of securing a large industry. The legal representatives of the other bidders made vigorous protests, contending that all the firms were not being treated on an equal basis, and that everyone ought to have the chance of submitting propositions similar to that of the Aztec Company.

The Asphalt and Supply Company, in a communication to the Controllers, pointed out that their company have now in course of completion tankage for 100,000 barrels of Mexican asphaltic oils, etc., and further, that they have leased for a long period of years from the Harbor Commissioners of Montreal the necessary land for the erection of a complete asphalt refinery, together with a wharf on the Tarte Pier. The communication also outlined that they are the sole Canadian agents for Lord Cowdray, the head of Messrs. S. Pearson & Sons, Limited, who own and control vast oil fields in Mexico. They have a contract for a long term of years with the above firm for the delivery of whatever oil they require, which must be delivered in Montreal by contract. The Asphalt & Supply Company, Limited, were prepared to complete the asphalt refinery and to guarantee to supply asphalt for terms of two, five or ten years, at $15.75 per ton delivered at the city yards, or $14.25 per ton delivered at any city yard in tank cars. Following the awarding of the tender, Mr. Charles P. Dubuc, representing John Baker, Jr., of New York, the agent for the Texas Company, obtained an interim injunction against the contract, on the ground that the other tenderers were not allowed to meet the offer of the Aztec Company, that the contract was not awarded to the lowest bidder, that the price was altered after its submission, and that the contract with the Aztec Company is contingent upon a possible contract for a longer term. In this the petitioners complain that the city has exceeded its authority and that consequently the contract is null and void.

The cut herewith illustrates the cover of catalogue B1 just issued by the Armstrong Manufacturing Company, Waterloo, Iowa. This company have been engaged in the manufacture of a line of portable well boring and blast hole drilling machinery since 1867, and their new catalogue describes their latest types of machines for this work, with both gasoline engine and electric motor drives. Several interesting reports of drilling in various quarries are given in the catalogue, and they appear to show rather economical operation. The company make their gasoline engines complete. Several pages of the catalogue describe in detail the features of the engines specially built for blast hole drill work.



The illustration reproduced herewith shows the Barrett Manufacturing Company's exhibit in the Mines and Metallurgy Building at the Panama-Pacific Exhibition. This exhibit is a graphic illustration of the wonderful possibilities of coal tar, and it is well worth seeing. Coal tar at once suggests Tarvia, which is now being used on thousands of miles of macadam on this continent; and there are the Barrett specification roofs, which consist of tarred felt and pitch. The many other products are too numerous to mention.


The Barrett Manufacturing Company's exhibit at the Panama Pacific Exposition.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Berlin, Ont.

Tenders will be received until 5 p.m., June 18th, by City Clerk A. H. Millar, for the construction of about 2,000 square yards of concrete pavement. Plans and specifications at office of the City Engineer, H. Johnson.

Brantford, Ont.

Plans have been drawn for sanitary sewers to be constructed on Burford, Sterling and Water Streets at an estimated cost of $6,000. Engineer, T. H. Jones.

Brockville, Ont.

The Town Council are considering the construction of pavements and sidewalks on various streets. Clerk, E. K. Dewey.

Caledonia, Ont.

The Town Council have received tenders on the construction of about 900 ft. of concrete sidewalk. Clerk, J. W. Avery.

Dundas, Ont.

Tenders on the construction of a storage dam, reservoir, etc., for the Utilities Commission, will be received until June 23rd by the Chairman, R. W. Karch, King Street. Plans and specifications at offices of the Commission and of the Engineers, McPhie, Kelly and Darling, Bank of Hamilton Building, Hamilton. Approximate cost, $6,000.

Eastview, Ont.

Tenders on the construction of about 3,750 feet of vitrified pipe sewer have been received by the Town Council.

Guelph Township, Ont.

The Township Council are having plans prepared for a concrete walk to be laid at College Heights. Clerk, James Laidlaw, Harrison Avenue, Guelph.

Guelph, Ont.

The construction of a reservoir is being considered by the City Council. Clerk, T. J. Moore.

Hamilton, Ont.

The City Council contemplate the construction of cement sidewalks and curbs on Hyde Park and West Avenues. Engineer, A. F. Macallum.

The laying of asphalt pavement on a number of streets and of a patented pavement on Alma Street is being considered by the City Council.

Howard Township, Ont.

Tenders on the construction of concrete culverts throughout the Township will be received until June 19th by the Township Clerk, George McDonald, Ridgetown.

Humberstone, Ont.

The Village Council have received tenders for the construction of about a mile of concrete sidewalks and curbs. Clerk, J. J. Wichmann.

Ingersoll, Ont.

The Town Council are about to submit a by-law to the ratepayers, providing for the issuing of debentures to the amount of $10,000 for repairs and extensions to the waterworks plant. Clerk, W. R. Smith.

Kingston, Ont.

Plans have been drawn for the construction of about 1,800 feet of 8-inch cast iron water main. City Engineer, R. J. McClelland, City Hall.

London, Ont.

The Board of Control will call for tenders shortly on the construction of Section No. 4 of the storm sewer system. Engineers, Chipman & Power, Mail Building, Toronto.

The City Council are considering the construction of the following works:—gravel roadway on Elizabeth Street, at an approximate cost of $3,698; gravel roadway on Salisbury Street, approximate cost, $1,548; new pavement on Princess Avenue. Engineer, H. A. Brazier.

Montreal, Que.

Tenders on the construction of a brick pump building will be received until June 22nd by the Board of Commissioners, City Hall. Plans and specifications at office of the Chief Engineer.

Ojibway, Ont.

The Town Council will call for tenders shortly on the laying of about 3½ miles of concrete pavement. Approximate cost, $100,000. Clerk, J. Moynahan, Windsor.

Orillia, Ont.

The Town Council are about to construct sewers by day labor under supervision of the Engineer, J. S. Blickensderfer. Material, 8-inch and 10-inch sewer tile, 2 feet long.

Sandwich South Township, Ont.

An agreement for the construction of a concrete road between Walkerville and Oldcastle is being entered into by the Town of Walkerville, Townships of Sandwich South and East and the Provincial Government. Work will be started shortly.

Simcoe, Ont.

The Town Clerk, W. C. McCaul, will receive tenders until June 21st for the construction of concrete sidewalks, estimated to cost about $6,000. Plans at office of Clerk.

St. Catharines, Ont.

The construction of pavements on various streets and a quantity of concrete sidewalk is being considered by the City Council. Clerk, P. W .Pay.

Sudbury, Ont.

Work on the construction of a tarvia roadway four miles long is about to start by day labor under supervision of Copper Cliff Town Council. Material has been purchased.

Toronto, Ont.

The Board of Control will receive tenders until June 22nd for the supply of 24-inch and 26-inch special iron castings for the High Level Pumping Station. Commissioner of Works, R. C. Harris.

The Board of Control will receive tenders until June 22nd for all trades required in the construction of floors at the High Level Pumping Station. Plans, etc., at office of City Architect, City Hall.

Wingham, Ont.

The Town Council are receiving tenders on the construction of a watermain on St. Patrick Street. Engineer, H. Campbell.

York County, Ont.

The York County Highways Commission have decided to lay a heavy asphalt pavement 18 feet wide on Dundas Street from City Limits to Scarlett Road. Engineer, E. A. Jones, 57 Adelaide Street E., Toronto.

Permission has been granted to Wright's Limited, 22 College Street, Toronto, to lay a watermain on Lansing side road east through Kingsdale Subdivision.

CONTRACTS AWARDED

Assiniboia, Man.

The Municipality have let the contract for the construction of vitrified sewers to Thomas Jackson & Sons, 370 Colony Street, Winnipeg, at $18,000.

Colchester South Township, Ont.

The contract for the construction of Silex walks on Brush and McLean Sts., has been awarded by the Township Council to M. Halstead Harrow, at 10½ cents per yard.

London, Ont.

A contract has been let to the Standard Paving Company, Litd., Central Chambers, Ottawa, for the construction of vitrified brick pavement on Ridout St. S. and Waterloo Street, at $2.70 per square yard.

McKillop Township, Ont.

The Township Council have awarded the contract for the construction of a tile drain to W. A. Stephenson, care of M. Murdie, Seaforth, Ont.

Stamford Township, Ont.

A contract for the construction of concrete sidewalks for the Township Council has been awarded to L. Gonder, Falls View P. O., at 9¾c. per sq. ft.

The contract for extensions to the waterworks at Lundy Park has been let by the Township Council to Frontier Construction Company, Niagara Falls South. A quantity of plate lead will be required. Approximate cost, $5,000.

Sydney, N. S.

The general contract for the construction of paving on George Street has been awarded by the City Council to Carritte Patterson Company, Limited, 23 Bedford Road, Halifax, and Wentworth Street, Sydney Tarvia penetration system. Approximate cost, $25,000.

The contract for structural steel and fittings for the pumping station at McDonalds Lake has been let by the City Council to Robert Musgrave, Commercial Street, North Sydney.

Transcona, Man.
Work will start shortly on the construction of about 7 miles of sewers for the Town Council. The contract for the work has been let to Van Hornbeeck, Holden & Christian, Limited, 464 Provencher Avenue, St. Boniface, Man. Approximate cost, $25,000.

The Town Council have let the contract for the construction of a sewage reservoir to Van Horenbeeck, Holden & Christian, 464 Provencher Avenue, St. Boniface. Estimated cost, $6,000.

Wallaceburg, Ont.
The Town Council have let the contract for laying water mains and sewerage force main to Wild & Bumbaca, Sault Ste. Marie, Ont., the contract for the construction of sewers to Murphy & Reed, Sandwich, and for the erection of a pumping station to C. McGregor, William Street, Wallaceburg.

York Township, Ont.
A contract for the construction of sidewalks on Brant, Edmund and St. Johns Road has been let by the Township Council to W. Bushell & Company, 2007 Davenport Road, Toronto.

Railroads, Bridges and Wharves

Beaverton, Ont.
G. Veale & Company are seeking permission for the construction of a dam.

Chatham, N.B.
The City Council contemplate the construction of a dam. Plans will be prepared by the Engineers, Lea & Coffin, and tenders called as soon as plans are approved.

Dunwich Township, Ont.
The Township Council will call for tenders shortly for cement work on Campbell Bridge. Clerk, D. A. McNabb, Dutton, Ont.

Haldimand County, Ont.
The County Council propose to construct five bridges and repair two. Clerk, H. Arrell, Cayuga.

New Brunswick Province.
Tenders for the construction of nine bridges on the main line of the Intercolonial Railway have been received by the Department of Railways & Canals, Ottawa. Secretary, J. W. Pugsley.

Saskatchewan Province
Material is being assembled for the completion of the Canadian Northern Railway from Bienfait to Estevan. Purchasing Agent, E. Langham, Winnipeg, Man.

Simcoe County, Ont.
Tenders will be received until June 21st by C. Wattie, Anten Mills, for the construction of concrete abutments for bridge on Minesing Road, Lot 9, Concession 8, Vespra Township. Plans at office of County Engineer, F. Barber, 57 Adelaide Street E., Toronto, and with Mr. Wattie.

L. Taylor, Victoria Harbor, will receive tenders until June 21st for the construction of concrete abutments for bridge on Town Line over Bear Creek, between Townships of Tay and Matchedash. Plans at office of County Engineer, F. Barber, 57 Adelaide Street E., Toronto, and with Mr. Taylor.

York County, Ont.
Tenders for the construction of a reinforced concrete truss bridge, span about 40 feet, will be received until June 18th by the York and Ontario County Councils. Engineer, F. Barber, 57 Adelaids Street E., Toronto.

CONTRACTS AWARDED

Calgary, Alta.
The contract for reinforcing steel in connection with the Centre Street Bridge has been awarded by the City Council to Wood, Vallance & Adams, Limited, 11th Avenue E., at $44 per ton.

Dunwich Township, Ont.
The contract for cement work on Clarke Bridge has been let by the Township Council to Williams & Walker, care of D. A. McNabb, Dutton, Ont.

St. Redempteur, Que.
The contract for the steel work and flooring in connection with the bridge being built for the Municipality has been awarded to Ontario Bridge Company, Crown Office Building, Toronto. Approximate cost, $4,500.

Tilbury West Township, Ont.
The contract for the erection of two bridges for the Township Council has been awarded to W. Bernard, Comber, at $4,000.

Wellington County, Ont.
The County Council have let a contract for the construction of two concrete bridges to Frontier Construction Company, Niagara Falls, Ont., and for the construction of four concrete bridges to F. Hunt, Holstein, Ont.

Public Buildings, Churches and Schools

Bismarck, Ont.
Tenders on the construction of a concrete basement for the school will be received until June 19th by Austin Eckers.

Bracebridge, Ont.
Tenders on fittings for the customs office will be received until 4 p.m., June 23rd, by R. C. Desrrochers. Department of Public Works, Ottawa. Plans and specifications with the Postmaster, Bracebridge, T. A. Hastings, Clerk of Works, Postal Station F, Toronto, and at the Department.

Claremont, Ont.
Tenders for the construction of a school for Section No. 14, Pickering, will be received until June 19th by the Secretary, F. M. Evans. Plans at office of Thomas Paterson.

Estevan, Sask.
Tenders on the erection of a church for the Presbyterian Congregation have been received by L. A. Duncan. Frame construction, concrete foundation, corrugated iron roofing. Approximate cost, $12,000.

Ethel, Ont.
Tenders will be received until June 25th by A. H. McDonald for the erection of sheds in connection with the Methodist Church. Frame construction, concrete foundation, corrugated iron roofing. Approximate cost, $3,500.

Galt, Ont.
A committee has been appointed by the Board of Education to select a site in the North Side district for the erection of a school. Chairman of Board, Hugh Grant.

Linwood, Ont.
Tenders will be received until June 18th by James Beggs for masonry, painting, and hot air heating required in the erection of a school. Plans and specifications with D. S. Williams, J. Beggs, and the architect, Louis Holle, King Street, Waterloo.

Marmora, Ont.
The time for receiving tenders on the erection of a public school has been extended to June 26th, on account of revision of the plans. Secretary to School Board, G. B. Airhart.

Medicine Hat, Alta.
Tenders will be received until 4 p.m., June 28th, by the Department of Public Works, Ottawa, for interior fittings for the Post Office. Plans and specifications with J. Trimble, Clerk of Works, Medicine Hat, W. T. Mollard, Clerk of Works, Regina, and at the Department. Secretary, R. C. Desrochers.

Preston, Ont.
Tenders will be called shortly for wiring, lighting and re-decorating the interior of the Lutheran Church. Pastor, Rev. F. Voelker.

South Walsingham Township, Ont.
Tenders on the erection of a brick veneered school for Section No. 11 will be received until June 25th by the Secretary, E. Hagen. Plans and specifications at residence of Secretary, Lot 10, Concession 5, South Walsingham.

St. Andrews, Man.
A by-law to authorize the expenditure of $6,000 in the erection of a school will be voted on by the ratepayers on June 28th. Municipal Secretary, J. D. Foster, Clandeboye.

St. John, N. B.
Tenders on interior fittings for the Post Office on Prince William Street will be received until 4 p.m., June 24th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications at office of D. H. Waterbury, Customs House, St. John, and at the Department.

Tavistock, Ont.
Plans for a library building have been prepared and are awaiting the approval of the Carnegie Library Trust. Estimated cost, $7,500. Town Clerk, J. G. Field.

Thorold, Ont.
Tenders on alterations and additions to the school for the Separate School Board will be received until June 21st by Rev. Father T. J. Sullivan, or the Ar-

Three Rivers, Que.
Tenders for the erection of a school will be received until 4 p.m., June 17th, by Arthur Beliveau, Secretary to the Roman Catholic School Commissioners. Brick and stone construction, concrete foundation, felt and gravel roofing.

Toronto, Ont.
The plans for an addition to St. Clair Avenue School have been approved by the Property Committee of the Board of Education. Tenders will be called for shortly. Secretary, W. C. Wilkinson,

chitect, T. H. Wiley, 128 St. Paul Street, St. Catharines.

Waubaushene, Ont.

The Roman Catholic Congregation are considering the erection of a church to replace that destroyed by fire last fall. Chairman of Building Committee, E. M. Garrity, Waubaushene.

Westboro, Ont.

The project for the erection of an addition to the Methodist Church has been abandoned.

Winnipeg, Man.

Tenders will be received until June 21st by the Chairman of the Board of Control for the construction of five balconies at the King Edward Memorial Hospital. Reinforced concrete, brick and steel construction. Architect, Inspector of Buildings, King and James Streets.

CONTRACTS AWARDED

Comber, Ont.

The contract for masonry and steel work in connection with the erection of St. Andrews Church has been let to W. Draper, 92 Adelaide Street, the plastering contract to Morgan Bros., 20 Cornhill Street, Chatham, and the painting contract to F. Palmer, 95 Adelaide Street. Roofing contract not let.

Gimli, Man.

The general contract for the erection of a school has been awarded to H. Sigurdsson, 804 McDermott Avenue, Winnipeg. Heating and electrical work will be sub-let. Approximate cost, $18,000.

Jeannette's Creek, Ont.

In connection with the school being built here, the contract for the masonry and carpentry has been let to Draper & McGee, 96 Adelaide Street, Chatham, the plastering contract to Morgan Bros., 20 Cornhill Street, Chatham, and the painting contract to W. Palmer, 95 Adelaide Street, Chatham.

London, Ont.

The contract for remodelling St. Mary's Roman Catholic School has been let to C. C. Liley, 558 Ontario Street. Approximate cost, $3,000.

Paris, Ont.

Charles Douglas, Mount Vernon, Ont., has commenced the erection of sheds for the Church Board. Concrete construction, corrugated iron construction.

Port Daniel, Que.

The contract for the construction of a steeple and for roofing the church and sacristy has been awarded to J. H. Morin & Son, Trois-Pistoles. Approximate cost, $5,500.

Summerside, P. E. I.

Work has been started on an addition to the school on Ottawa Street by Peter G. Clarke, Notre Dame Street. Estimated cost, $18,000.

Business Buildings and Industrial Plants

Baddeck, N. S.

The erection of a flour mill is being considered by the Department of Agriculture, Truro, N. S. Secretary, Melville Cumming, Truro. Machinery of the latest rural mill type will be required.

Barnston Township, Que.

Work is about to start on the construction of a sawmill by W. K. Baldwin, Baldwin's Mills, Que. Owner is in the market for machinery, shafting, belts, etc. Approximate cost, $10,000.

Brantford, Ont.

Tenders for the installation of a steam heating system in a store on Colborne Street will be received until June 19th by W. C. Livingston, 88 Brant Avenue. Plans and specifications at office of the Architects, Angus & Angus, North Bay, with the owner and at office of Contract Record, 347 Adelaide Street West, Toronto.

Bridgewater, N. S.

The Acadia Gas Engine Company, King Street, have commenced the erection of alterations to their foundry, estimated to cost between $5,000 and $10,000. Machinery, castings, etc., will be required.

British Columbia Province

The Department of Agriculture are considering the construction of a number of silos at Burton, Arrow Lake, Revelstoke, Kelowna, Ladysmith, Summerland, Penticton, Salt Spring Island, Armstrong, Denison and Ladner.

Dashwood, Ont.

Work has been started on the erection of an addition to the grist mill of Jacob Kellerman. White brick construction, concrete foundation, shingle roofing. Estimated cost, $7,000.

Hamilton, Ont.

The Canadian Hart Wheel Company, Limited, Barton Street E., contemplate the erection of an addition to their factory, estimated to cost $3,000. Brick construction, concrete foundation, concrete floors.

London, Ont.

Plans will be prepared for a three-storey brick addition to the plant of the Ford Motor Company of Canada, Limited, 297 Dundas Street. Work may not start till 1916.

Muncey, Ont.

The farm buildings of the Mount Elgin Institute, which were recently destroyed by fire will be replaced with fireproof structures. Creamery and dairy equipment will be required. Particulars from Rev. S. R. McVitty.

North Portal, Sask.

The Town Council contemplate the erection of a skating rink, at an estimated cost of $3,500. A by-law has been passed for this purpose. Secretary, G. H. Wilks.

Okanagan Landing, B.C.

The erection of a station, roundhouse and turntable is contemplated by the Canadian Pacific Railway, head office, Montreal. Superintendent, J. F. Richardson, Vancouver.

Peterboro, Ont.

The City Council have decided to pass a by-law at once giving the Utilities Commission authority to erect a substation on Sherbrooke Street at an estimated cost of $41,800. Engineer, H. O. Fisk.

Sherbrooke, Que.

Work is about to start on the erection of an addition to the market building on King Street. Work by day labor under supervision of Building Inspector A. Dion. A refrigeration plant will be installed.

St. Catharines, Ont.

Tenders will be received until June 23rd by A. E. Nicholson, Architect, 46 Queen Street, for the erection of two stores for George Ecclestone.

Tenders on the erection of a storage building for the McKinnon Chain Company will be received until June 17th by Krumm & Lynar, Engineers, Queen Street, St. Catharines. Reinforced concrete and steel construction, concrete floors, steel sash. Plans and specifications at offices of the Engineers and of MacLean Daily Reports, 25 Charlotte Street, Toronto. Sub-tenders on all trades are being received by the Sutherland Construction Company, Limited, Ryrie Building, Toronto.

Tenders will be received until June 17th by Krumm & Lynar, Engineers, Queen Street, for an addition to the japanning building of the McKinnon Dash & Hardware Company. Reinforced concrete and steel construction, steel sash, concrete floors. Plans and specifications with the Engineers and with MacLean Daily Reports, 25 Charlotte Street, Toronto. Sub-tenders on all trades are being received by the Sutherland Construction Company, Limited, Ryrie Building, Toronto.

Sydney, N. S.

F. & J. Morley, 386 Charlotte Street, are considering the repairing of the store recently damaged by fire. Approximate cost, $4,000.

Toronto, Ont.

Work has been started on the erection of a store and residence at 1234 St. Clair Avenue by J. Tupling, 1242 St. Clair Avenue. Masonry and carpentry will be done by day labor. Smaller trades will be sub-let. Estimated cost, $3,500.

The plans for a barn and stables to be erected at the Jail Farm have been approved by the Board of Control. Tenders will be called shortly. Concrete and timber construction. Estimated cost, $50,000.

Weyburn, Sask.

Plans for a curling rink to be erected for the Weyburn Arena Company have been prepared by George J. Garrett. Approximate cost, $10,000.

CONTRACTS AWARDED

Brantford, Ont.

The general contract for the erection of a departmental store on Colborne Street for W. C. Livingston, 88 Brant Avenue, has been awarded to Schultz Bros. & Company, Limited, 35-47 Albion Street. Heating may be sub-let. Approximate cost, $70,000.

Calgary, Alta.

The general contract for the erection of stores and offices for T. J. Skinner has been let to T. Baird, P. O. Box 1337. Architect, T. J. Holman, 328 Eighth Avenue W. Brick and steel construction, concrete foundation, felt and gravel roofing. Approximate cost, $16,500. T. Baird also has the contract for alterations to store and offices on Eighth Avenue for Mr. Skinner.

Halifax, N. S.

F. R. Little, 150 Spring Garden Road, has let the contract for the erection of a business block to Thomson & Theakston, 116 Hollis Street. Concrete construction.

Hamilton, Ont.

In connection with the warehouse be-

(Continued on page 51)

Tenders and For Sale Department

Tenders Wanted

Sealed tenders will be received up to and including **Monday, June 21st**, by the Secretary of the Board of Education, Brighton, Ont., in whole or in part, for the different trades required in the erection and completion of a Union School Building. Plans and specifications can be seen and all particulars obtained from the Department of Agriculture Offices, Brighton; also at the offices of the Architects. No tender necessarily accepted.

E. C. BROWNE,
Sec.-Treas., Board of Education,
Brighton, Ont.

Ellis & Ellis, Architects,
Manning Chambers, Toronto. 23-24

Notice to Contractors

Sidewalks

Sealed tenders will be received, addressed to the Chairman of the Board of Works, City Buildings, St. Catharines, Ont., up to **noon of Thursday, June 24th, 1915**, for the construction of approximately 15,500 lineal feet of four and five foot concrete sidewalk and combined concrete curbs, also 4,000 feet of four-foot concrete sidewalk.

Plans and specifications and a list of the streets may be seen at and forms of tender obtained from the office of the City Engineer. Envelopes containing tenders must be marked as to contents. All tenders must be accompanied by a marked cheque for 5 per cent. of the amount of the tender, together with the names of two personal sureties or the bond of a guarantee company, approved by the City Treasurer. The lowest or any tender is not necessarily accepted.

W. P. NEAR,
City Engineer.
24

TOWN OF WALKERVILLE

Tenders for Pavements and Sidewalks

Sealed tenders will be received by registered post, addressed to the undersigned, up to noon on **Thursday, the 24th day of June, 1915**, for the construction of pavements and sidewalks in the Town of Walkerville, as follows:

Concrete pavement on Edna Street from Walker Road to the P. M. Railway;

Concrete pavement in Alley West of Walker Road from Huron Street South to Ontario Street;

Re-surfacing Tuscorora Street, with asphalt block from Walker Road to Devonshire Road;

Re-surfacing Niagara Street, with asphalt block from Walker Road to Monmouth Road;

Cement sidewalks on the West side of Devonshire Road, between Huron and Ontario, and on West side of Kildare Road between Huron and Ontario;

Plans and specifications may be seen on application to Owen McKay, C.E., Walkerville.

Tenders must be accompanied by a marked cheque, payable to the Town Treasurer, equal to 5 per cent. of the amount thereof.

Should any party whose tender is accepted fail to execute the necessary contract and bond for the due fulfilment of the same, his deposit will be forfeited to the town.

Deposits of unsuccessful tenderers will be returned.

The lowest or any tender not necessarily accepted. The names of two responsible persons to act as sureties must accompany tender.

CECIL H. ROBINSON,
Town Clerk.
Walkerville, June 12, 1915. 24

TENDERS

Tenders will be received by the undersigned for the construction of concrete sidewalks for the Town of Simcoe, up to twelve o'clock noon on **Monday, the 21st of June, 1915**. Estimated cost of work $6,000.

Plans and specifications can be seen at the Clerk's office, Peel Street, Simcoe, Ont.

W. C. McCALL,
Town Clerk.
24

COUNTY OF BRANT

Fairchild's and Manwaring Creek Bridges

Governor's Road

Sealed tenders, clearly endorsed on the outside "Tender for Steel Superstructure Fairchild's & Manwaring Creek Bridges," or "Tender for reinforced concrete abutments Fairchild's Creek & Manwaring Creek Bridges," will be received by the County of Brant up to 12 noon on **Wednesday, 30th of June, 1915.**

The bridges are each of 60 ft. clear waterway, 16 ft. roadway, and Class "A" loading, and are situated within [illegible] mile of each other, 3¼ miles south-west of Harrisburg Junction.

The abutments contain 152 cu. yds. and 170 cu. yds. respectively.

Plans and specifications may be seen at the office of the County Engineers, Jackson & Company, Temple Building, Brantford, from whom tender forms may be obtained.

Tenders must be addressed to the County Clerk, County Building, Brantford.

ALAN MAIR JACKSON,
County Engineer.
24-25

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, June 25th, 1915

for

Enlargement, St. Clair Avenue School

and

Repairs and Improvements at Sundry Schools

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall **not later than 4 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. C. WILKINSON,
Secretary-Treasurer.

MILES VOKES,
Chairman of Committee.
24

Alternator Wanted

Modern revolving field, three bearing, 60 cycle alternator for belt drive. Size 300 to 375 K.V.A. 3 phase, 2300 volt, with belted or direct connected exciter. Speed if 300 R.P.M. preferred. Must be in first-class condition and complete with bed plate, rails, rheostats, etc. Panel not necessary.

Give full details, make, serial number, age, where used and delivery. Price wanted f.o.b. cars.

Hydro-Electric Power Commission of Ontario,
24 Continental Life Bldg., Toronto, Ont.

Notice to Contractors

Pavements

Sealed tenders will be received, addressed to the Chairman of the Board of Works, City Buildings, St. Catharines, Ont., up to **noon, Thursday, June 24th, 1915**, for the construction of pavements of approximately the following yardage:

17,500 yards of Bitulithic or Asphaltic Concrete.
11,200 yards of Creosoted Wood Block.
1,000 yards of Vitrified Brick Block.

Plans and specifications and a list of the streets may be seen at and forms of tender obtained from the office of the City Engineer. Envelopes containing tenders must be marked as to contents. All tenders must be accompanied by a marked cheque of 5 per cent. of the amount of the tender, together with the names of two personal sureties or the bond of a guarantee company, approved by the City Treasurer. The lowest or any tender is not necessarily accepted.

W. P. NEAR,
City Engineer.
24

Board of Education

New Central Technical School

The Advisory Industrial Committee of the Board of Education will receive sealed tenders, addressed to the Secretary-Treasurer on or before

Tuesday, June 22nd, 1915

for

Iron Fence, to be erected around the grounds of the new Central Technical School, Lippincott Street

Flag Pole, to be supplied and erected on the grounds

Plans and specifications may be seen on and after **Friday, the 11th of June**, at the office of the Architects, Messrs. Ross & Macdonald, 908 Royal Bank Building. Each tender must be accompanied by a certified cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by a Surety Company. Tenders must be in the hands of the Secretary-Treasurer, at his office in the City Hall, **not later than 4 o'clock p.m.** on the date mentioned, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

RHYS D. FAIRBAIRN,
Chairman Advisory Industrial Committee.

W. C. WILKINSON,
Secretary-Treasurer.
24

Tenders for Pavement

Sealed tenders, addressed to A. H. Millar, City Clerk, will be received up to 5 o'clock p.m., **June 18**, for the construction of approximately 2,000 sq. yds. of concrete pavement in the City of Berlin. Plans and specifications may be seen at the office of the City Engineer. The lowest or any tender will not necessarily be accepted.

HERBERT JOHNSTON,
City Engineer.
23-24

Tenders for Construction of Sidewalks

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, June 21st, 1915**, for the construction of concrete sidewalks on Harvie and Bloem Avenues in the Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Township Engineer.
Toronto, June 11, 1915. 24

Concrete Bridge Tenders

Sealed tenders will be received by Jas. Beattie, Esq., County Clerk, Fergus, up to 2 p.m. on **Monday, June 21st**, for the construction of two small concrete bridges on the boundaries between the Counties of Wellington and Waterloo and Dufferin respectively. For plans and other information apply to office of County Clerk or to

C. R. WHEELOCK,
Engineer of Dufferin, Orangeville, Ont.

BOWMAN & CONNOR,
Engineers of Wellington and Waterloo
Berlin and
24 31 Queen Street West, Toronto.

Construction of Sewers

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, June 21st, 1915**, for the construction of sewers on Barrington and Earlscourt Avenues, in the Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Township Engineer.
Toronto, June 11, 1915

Business Opportunity

Will sell Canadian patent rights Baltzer System of constructing inexpensive concrete houses. Only successful system of kind. Most comfortable, durable, attractive, 5-room houses built. Simple apparatus. System has fully demonstrated its worth in the United States. Approved by Government. Write for details immediately.

AUGUST BALTZER,
Severance Building,
21-25 Los Angeles, Cal

Business Buildings and Industrial Plants

(Continued from page 49)

ing erected at Canno and Catharine Sts. for Davis Bros., 2 Park Street S., the contract for roofing has been let to M. Smith, King Street and Arthur Avenue, the plastering contract to J. Moores, 170 Cumberland Avenue, and the painting contract to Thomson & Company, 36 Edward Street. Heating and plumbing contract not let.

Montreal, Que.

The general contract for the re-erection of the premises of James Strachan, Limited, 246 City Hall Avenue, has been let to P. Lyall & Sons Construction Company, Limited, Transportation Building, Montreal. Plans for the work are being prepared by Sydney Comber, 304-305 Coronation Building, Montreal.

Port Colborne, Ont.

The contract for the erection of a skating rink for the Port Colborne Rink Company has been let to A. Sweet, King Street. Frame and galvanized iron construction.

Toronto, Ont.

In connection with the store and residence being erected at Yonge and Pleasant Streets by E. A. James, 57 Adelaide Street E., the contract for masonry has been let to J. H. Jennings, 49 St. Clair Avenue E.

The Board of Control have let the contract for roofing the John Street boiler house to Chalkley & Son, 34 Victoria Street, at $9,374.

In connection with the stores and apartments being erected at 382 Roncesvalles Avenue by W. J. S. Tremaine, 171 Keele Street, the contract for plumbing and heating has been let to W. F. Snow, 160 Huron Street. Plastering and painting by day labor.

Verdun, Que.

The contract for the erection of a residence and stores on Wellington Street for Paul Lalonde, LaSalle Road, has been let to J. O. Hamelin, 1324 Wellington Street. Brick construction. Estimated cost, $6,000.

Residences

Dundas, Ont.

Plans are being drawn for a residence to be erected on Melville Street for Gordon Stevens, McMurray Street. Brick construction, stone and concrete foundation, shingle roofing. Approximate cost, $3,500.

Halifax, N. S.

Work is in progress on the erection of flats by the Eastern Investment Corporation, Limited, Cragg Building. Frame construction, concrete foundation, shingle roofing. Estimated cost, $6,000.

London, Ont.

The plumbing, heating and painting in connection with the residence being built for E. T. White, Wortley Road, by the London Contracting Company, Richmond Street, will be sub-let.

Plans have been drawn for thirteen residences to be erected on Briscoe St. for Alexander Campbell, 731 Waterloo Street. Work on two of these will be started at once. Red pressed brick construction, concrete foundation, slate and shingle roofing. Estimated cost, $4,000 each.

Montreal, Que.

J. P. Tremblay, 291 Prudhomme Ave., is erecting two flats on Old Orchard Street, at an estimated cost of $6,000.

Ottawa, Ont.

Charles Holbrook & Son, 425 Somerset Street, are receiving prices on plastering, painting, heating, plumbing, and electrical work in connection with the apartments being built on Elgin Street. Approximate cost of building, $20,000.

C. D. Joyce, 1102 Somerset Street, is receiving prices on plastering, painting, heating, plumbing and electrical work in connection with the alterations and additions to apartments on Somerset St.

Bower Bros., 133 Hopewell Street, are receiving prices on plastering, painting, heating, plumbing and electrical work for the residence being built on Aylmer Street.

W. C. Leech, 140 Spadina Avenue, contemplates the erection of a residence on Irving Street, at an estimated cost of $4,500. Brick veneer construction, stone foundation, shingle roofing.

The erection of a residence on Chapel Street is being considered by Gervin & Helmer, 150 Gloucester Street. Frame and stucco construction, stone foundation, shingle roofing. Approximate cost, $4,000.

Quebec, Que.

A residence is being built by day labor on Des Stigmates Street for Audina Nolin, 113 Des Stigmates Street. Brick construction, felt and gravel roofing. Approximate cost, $6,000.

Three Rivers, Que.

J. Lessard, 2 Cooke Street, has commenced the erection of a residence on Laviolette Street. Estimated cost, $4,000.

Toronto, Ont.

Work has been commenced by G. T. Death, 244 Sheldrake Avenue, on the erection of a residence at 80 Glancairn Street. Smaller trades will be let. Approximate cost, $5,000.

Work on the erection of a residence on Glenholme Avenue has been started by P. L. Speers, 20 Biggar Avenue. Brick construction, shingle roofing. Estimated cost, $4,500.

J. Crang, 906 St. Clair Avenue West, is building a pair of residences at 30-32 Appleton Avenue, estimated to cost $5,000. Brick construction.

Plans have been drawn for a pair of residences to be built at Tyrell and Arlington Streets by B. J. Case, 34 Nina Street, brick construction, shingle, felt and gravel roofing. Estimated cost, $4,500.

Winnipeg, Man.

A residence is being built on Bartlett Street by R. C. Mitchell, 312 Florence Avenue, at an estimated cost of $4,500. Owner will sub-let painting, heating, plumbing and electrical work.

Work has been started by L. H. Hall, 87 Lipton Street, Rockwood, on the erection of a residence on Grosvenor Street. Brick construction, shingle roofing. Estimated cost, $8,000.

CONTRACTS AWARDED

Belleville, One.

Work has been started on the erection of two residences on Murney's Hill Road, for Arthur Gale, 75 West Bridge Street. Work is being done by day labor under supervision of John Young.

Brick construction. Approximate cost, $4,200.

Ford City, Ont.

The masonry contract in connection with the erection of a residence on Belle Isle Avenue for Henry Plante has been let to George Desjardins. Pressed brick construction, concrete block foundation, shingle roofing. Estimated cost, $4,000.

Grey Township, Ont.

The general contract for the erection of a residence for Andrew Lamont, Concession 10, Grey Township, has been let to Parks & Brown, Brussels, and the carpentry contract to John Hunter, Brussels. Approximate cost, $3,500.

Hamilton, Ont.

In connection with the erection of a residence on Prospect Street, J. Knight, 227 Hunter Street, has let the contract for painting to D. O'Neil, 80 Simcoe Street E., the heating contract to J. N. Luxon, 607 Barton Street E., and the electrical contract to L. H. Sanders, 110 King Street W.

The heating and plumbing contract in connection with the residence being built for T. H. Pratt, 20 James Street N., has been let to G. Stevenson, 14 Walnut Street S.

In connection with the residence being erected on Laurie Avenue for R. M. Aylesworth, 75 Hughson Street, the contract for plastering has been awarded to Hannaford Bros., 232 Robinson Street. Painting, heating, plumbing, and electrical work not let.

The following contracts have been let in connection with the erection of a residence on Main Street W. for Miss M. A. Hardman, 167½ Main Street E.:—masonry, A. Beddie, Burris and Cumberland Streets; carpentry, and roofing, W. Hill, 169 Homewood Avenue; plastering, H. Hancox, 41 Robins Avenue; painting, D. O'Neil, 80 Simcoe Street E.; heating and plumbing, J. N. Luxon, 607 Barton Street E.; tinsmithing, V. Drew, 261 Connon Street E. Electrical work not let.

Harwich Township, Ont.

The general contract for the erection of a residence for A. T. Maynard, Chatham, has been let to Frank Sparks, Sandye Street, Chatham. Brick construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

London, Ont.

L. Summers, Dundas and Maitland Streets, has awarded the general contract for the erection of a residence on Dufferin Avenue to Harry Hayman, 491 Ontario Street. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $3,600.

The contract for the construction of a brick residence at 980 Richmond Street for John Crockett, has been awarded to J. A. Stanley, c/o owner, 980 Richmond Street. Concrete foundation, slate roofing. Estimated cost, $3,500.

Montreal. Que.

Work has been started on the construction of five flats for Joseph Lebeau by Lebeau & Fils, 1014 Henri Julien Avenue. Estimated cost, $5,000.

North Bay, Ont.

In connection with the erection of a residence on Front Street for W. Aubrey, the general contract, carpentry, masonry, steel, roofing, plastering, and painting contracts have been awarded to J. H. Marceau. The contracts for heating, plumbing, and electrical work not yet awarded.

Ottawa, Ont.

The contract for heating and plumbing in connection with alterations to a residence on Gloucester Street for Miss S. M. O'Grady, has been awarded to McKinley & Northwood, 56 Rideau Street.

In connection with alterations to apartments on Metcalfe Street for Mrs. J. Cameron, 122 Argyle Avenue, the contract for plumbing has been let to J. T. Blythe, Frank Street, and for electrical work to G. W. Matthews, 700 Albert Street.

The contract for plumbing in connection with the residence being built by J. D. Robertson, 64 Evelyn Street, has been let to F. Williams, c/o owner, and the contract for electrical work to P. Ackroyd, 416 Bank Street.

Quebec, Que.

The roofing contract in connection with the residence being built by J. Gauchon, 364 Richelieu Street, has been awarded to A. Durand, 42 St. Agnes Street, and the contract for heating, plumbing, and electrical work to O. Vezina, 83 Victoria Street. Owner will do carpentry, plastering, and painting.

The masonry contract in connection with the residence being erected on St. Louis Street for E. Guimond, 40 St. Louis Street, has been let to Pierre Tardif, 260 Napoleon Street.

G. Cantin, 22 Lee Street, has let the contract for masonry and plastering in connection with the residence being erected on Cremazie Street, to A. Fackney, St. Joachim Street, and the roofing contract to O. Barbeau, 154 Franklyn.

The masonry and plastering contract in connection with the residence being built on St. Nazaire Street by J. Lafond, 146 St. Nazaire Street, has been let to Poulin & Marcoux, 144 Latournelle Street.

In connection with the residence being erected at 4th Street and 5th Avenue, Limoilou, by A. Laplante, 74 Sixth Avenue, Limoilou, the masonry and plastering contract has been let to Villeneuve & Frere, 168 2nd Street, and the carpentry contract to Freres Pouliot, 94 Sixth Avenue, Limoilou. Painting contract not yet let. Roofing, heating, plumbing, and electrical work will be done by owner.

Renfrew, Ont.

The general contract for the erection of a residence has been let by D. McKillop, Raglan Street, to W. A. Moore, Opeongo Street. Brick veneer construction. Approximate cost, $3,000.

Three Rivers, Que.

The contract for the erection of a residence for A. Carigan, 8 St. Prosper Street, has been awarded to Emery Bergeron, 117 St. Olivier Street. Brick, cement block, and frame construction. Approximate cost, $8,000.

Work has been started by A. Provencher, 10 Cloutier Street, on the erection of a residence for J. Bondreault, Laviolette Street. Brick and frame construction. Estimated cost, $4,000.

Toronto, Ont.

The contract for heating in connection with the residence being erected on Cortleigh Crescent for F. G. Marriott, 27 Lytton Boulevard, has been awarded to Trickey & Clifton, 500 Wychwood Avenue. Painting, plastering and wiring not awarded.

A residence is being built at 16 Glencairn Avenue by Davies Bros. The painting and heating contracts have been awarded to A. McKennedy, 103 Belsize Drive. Approximate cost, $5,000.

The contract for heating in connection with the residence being built at 199 Westminster Avenue for J. McArthur, 66 Elmgrove Avenue, has been awarded to R. C. Mansell, 85 Quebec Avenue.

J. W. Ellis, 438 Roncesvalles Avenue, has let the contract for plastering in connection with the erection of apartments to Sparks & Son, 188 Sorauren Avenue. Painting by day labor.

In connection with the residences being erected on Renhold Street by J. Gibson, 2148 Yonge Street, the masonry contract has been let to A. Dezorzi, 879 Shaw Street, aend the carpentry contract to J. Avison, 164 Marangueretta Street.

The heating and plumbing contract in connection with the residence being built by A. F. Foster, 453 Rushton Road, has been awarded to G. E. Wimpenny, 59 Boon Avenue, and the contract for plastering to G. J. Milne, 530 Lansdowne Avenue. Painting contract not let.

P. W. Coltman, 93 Christie Street, has let the contract for masonry in connection with the erection of three residences on Tyrell Street to J. A. Kitchen, 209 Humberside Avenue, and the carpentry contract to A. Holmes, 40 Cloverdale Avenue.

A. Holmes, 40 Clovesdale Avenue, has let the contract for plumbing in connection with the erection of two residences on Ossington Avenue to W. Boxall, 1083 St. Clarens Avenue, and the contract for heating to A. W. Gilmour, 1108 Dovercourt Road.

The contract for plumbing and heating in connection with the residence being built on Stibbard Street by Sparrow & Holden, 167 Rowan Avenue, has been let to George Moore, 165 Rowan Avenue, and for electric wiring to F. A. Turpin, 116 Brunswick Avenue.

Windsor, Ont.

The general contract for the erection of a double residence has been let by E. G. Milligan, Heintzman Building, Ouellette Avenue, to Blais & Ramsey, Heintzman Building. Estimated cost, $5,000.

Winnipeg. Man.

A residence is being built on Grasvenor Avenue by P. S. Wright, 12 Harrow Apartments. The contract for plumbing and heating has been awarded to Randall & Bell, 445 Portage Avenue. All other work to be done by owner. Approximate cost, $7,000.

Power Plants, Electricity and Telephones

Dorchester, Ont.

A by-law has been carried to obtain power from the Ontario Hydro-Electric Commission and authorizing the construction of a distribution plant, at a cost of $4,300. Clerk to Town Council, W. B. Lane.

Kelowna, B.C.

The City Council contemplate the installation of a hydro-electric plant at a cost of $120,000. Engineers, Du Cane, Dutcher & Company, 470 Granville Street, Vancouver.

London, Ont.

C. S. Hyman Company, Limited, Richmond Street, contemplate the installation of hydro equipment for developing an additional 200 h.p.

Montreal, Que.

Tenders will be received until June 21st, by L. N. Senecal, Secretary to City Council, for the supply and installation of underground cables, overhead cables, street pedestals, alarm boxes, cable boxes and accessories for St. Catherines and Bleury Streets and Park Avenue. Plans and specifications at office of Purchasing Department.

Petrolia, Ont.

The Town Council are considering the installation of hydro power and remodelling the existing plant, at a cost of about $35,000. Clerk, J. McHattie.

Victoria, B.C.

The British Columbia Telephone Company, 555 Seymour Street, Vancouver, propose to make extensions to their system, estimated to cost $70,000.

Wentworth County, Ont.

The County Council contemplate the installation of electric lighting on Stoney Creek Road from the City Limits to Hamilton to Red Hill. Clerk, J. W. Jardine, County Court House, Hamilton.

CONTRACTS AWARDED

Calgary, Alta.

The contract for the supply of paper insulated, lead covered, underground cable has been let by the City Council to General Supplies, Limited, 112 11th Avenue W.

Graytown, Sask.

The West Graytown Rural Telephone Company, Limited, have let the contract for the construction of their telephone system to W. D. Craig, Princess Theatre Block, Regina. Material will be furnished by contractor. Approximate cost, $11,200.

Fires

Allanburg, Ont.

Fire has destroyed a house on the west bank of the canal, belonging to the Department of Public Works, Ottawa.

Bradford, Ont.

Fire has completely destroyed a barn belonging to B. B. Collings, Holland Street, causing a loss of $4,500.

Herbertville, Que.

A sawmill belonging to Adelard Dubois has been destroyed by fire. Loss, $25,000.

Hull, Que.

The residence of Alexis Herbert, 41 Papineau Street, has been destroyed by fire, with a loss of $3,000.

Lambton, Ont.

Fire has destroyed the following properties:—Lambton House, proprietor, D. F. Downey, owner, Home Smith Company, 18 King Street W., Toronto; store and post office, owned by H. Phillips; residence of H. B. Jarvis.

London, Ont.

The Thompson Knitting Mills, 77 Dundas Street, have been gutted by fire, causing a loss of $20,000. Machinery and stock destroyed.

Merritt, B.C.

The Central Hall, the property of Cleasby & Eastwood, has been destroyed by fire. Loss, $8,000.

Moncton, N.B.

A warehouse belonging to the Harris Estate has been destroyed by fire. Loss, $5,000, insurance, $1,500.

Montreal, Que.

The plant of the Valleyfield Iron Works has been gutted by fire, causing a loss of $10,000. Owners, Webster & Sons, Limited, 31 Wellington Street.

Fire has destroyed the premises of the Union Brewery, Limited, 592 Cadieux Street. Loss, $30,000, covered by insurance.

New Toronto, Ont.

A store and residence on the Lake Shore Road, belonging to J. A. Wilson & Company, has been destroyed by fire. Loss on building and contents, $5,000.

North Bay, Ont.

D. Barker's planing mill has been gutted by fire.

Ottawa, Ont.

Stables belonging to J. Torontows, 27 McGee Street, have been destroyed by fire, with a loss of $4,000.

Two residences, the property of J. A. Primeau, 28 McGee Street, have been destroyed by fire. Loss, $5,000.

The residence of J. Fogarty, Holland Avenue, has been gutted by fire. Loss, $3,000.

The premises of Doucet & Charbon-

To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

from

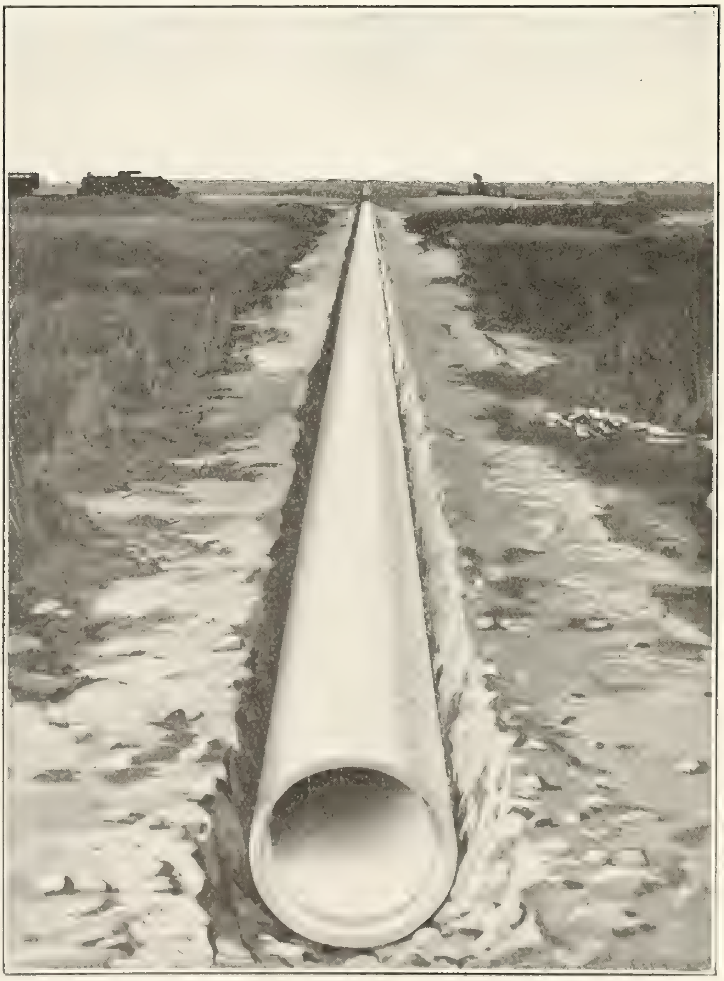
Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.



neau, Wellington Street, reported in our last issue as having been destroyed by fire, are owned by Donald Hector McLean, Central Chambers.

Playfair, Ont.
J. E. Playfair's cheese box factory has been destroyed by fire, entailing a loss of $1,500. Machinery destroyed. Owner will rebuild.

Russell, Ont.
A disastrous fire has caused the following losses:—R. W. Cherry, stores, $3,500, insurance, $3,200; R. W. Murray, tinsmith, $3,000, insurance, $2,500; T. Kitchen, store, $2,000; J. Cameron, $3,000, insurance, $1,600; Mrs. B. Scharff, Brockville, residence, $2,500, insurance, $1,500; J. Mathers, residence and garage, $3,000; S. Stephenson, business block, $11,000; H. Cordell, bakery, residence, and stables, $6,000, partially insured; Town Hall, $1,500, insurance, $500; County Registry Office, $4,000, partly insured; Public Library, $2,500, partially insured; Kenney Bros., store and office, $2,000; business block, store and offices, $8,000 on building; Mrs. Oliiver Boyd, business block, $2,000; Mrs. W. Stearns, business block, $3,000, insurance, $1,500.

Shawinigan Falls, Que.
Fire has partly destroyed the Roman Catholic Church here, causing a loss of $20,000, partially insured.

Sorel, Que.
Fire has gutted the works of the Sore Bottling Company, Limited, causing a loss of $7,000. The factory will be rebuilt, and machinery will be required.

Toronto, Ont.
Stables at 40 Blake Street, the property of Joseph Russell, 42 Blake Street, have been destroyed by fire. Estimated loss, $2,500, covered by insurance.

Fire has destroyed two residences at 391-393 Caledonia Avenue, owned by W. Hulme and L. Paton. Loss, $4,000.

Miscellaneous

Cabri, Sask.
The Village Council are in the market for fire equipment, to cost approximately $5,000. Secretary, J. W. Hopton.

Calgary, Alta.
The City Council are considering the erection of comfort stations, at an estimated cost of $26,000. Clerk, J. M. Miller.

Chatham and Dover Townships, Ont.
Tenders for dredging and ditching Big Creek Drain will be received until 1 p.m., June 26th, by the Reeve of Chatham Township, W. H. Wickens, Skane Block, Chatham. Plans and specifications at office of the Reeve and with G. A. McCubbin, 135 King Street, Chatham.

Courtenay, B.C.
The Department of Public Works, Ottawa, have been granted an appropriation for 3,000 feet of dredging in the mouth of the Courtenay River, the construction of retaining walls and the blasting of two rock bars.

Dunnville, Ont.
Tenders on the supply of road oil are being received by the Town Council, J. W. Holmes.

Halifax, N.S.
The Standard Construction Company, Metropole Building, are receiving prices on a quantity of spruce piling and deals.

Lambeth, Ont.
Tenders will be received until noon, June 18th, by James A. Bell & Son, Engineers, St. Thomas, for drilling an 8-inch artesian well. Plans and specifications with Village Clerk, G. Riddell, Wilton Graev, and at office of Engineers.

London, Ont.
The Board of Control have recommended the purchase of a combination chemical wagon from the American-LaFrance Fire Engine Company, Elmira, N.Y., at a cost of $7,850. Mayor, H. A. Stevenson.

Orillia, Ont.
The National Hardware Company, Limited, 95 Barrie Road, contemplate the installation of machinery for the manufacture of shells.

Toronto, Ont.
The Board of Control will receive tenders until June 22nd for the supply of equipment for the machine shop at the High Level Pumping Station. Commissioer of Works, R. C. Harris.

Tenders will be received until June 22nd by W. C. Wilkinson, Secretary to the Board of Education, City Hall, on the erection of an iron fence around the grounds of the Technical School, Lippincott Street, and a flag pole. Plans, etc., at office of the Architects, Ross & Macdonald, 908 Royal Bank Building, Toronto.

The Board of Control will receive tenders until June 22nd for the supply of approximately 300,000 granite setts. Commissioner of Works, R. C. Harris, City Hall.

CONTRACTS AWARDED

Ottawa, Ont.
The City Council have awarded a contract for the supply and installation of a pump to Heap & Partners, Canada, Limited, 24 Victoria Square, Montreal.

Sherbrooke, Que.
The City Council have awarded a contract for the supply of 750 fet of fire hose to Codere Sons & Company, Arrow Brand, at 95c. per foot, and for 250 feet, Red Cross Brand, to J. S. Mitchell & Company at $1.00 per foot.

Late News Items

Calgary, Alta.
Fire has destroyed a store on Eighth Avenue, belonging to J. O. Trotter, 1221 Seventeen A Street, N.W. Loss, $12,000, covered by insurance.

Clinton, Ont.
Tenders on the carpentry required in an extension to the library will be received until June 22nd by W. Brydon, Chairman of the Stavely Library Trust. Plans and specifications at Mr. Brydon's office. Architect, J. A. Fowler, Goderich.

Dartmouth, N.S.
Tenders for the installation of a hot water heating system in St. Peter's Hall will be received until June 19th by G. J. De Louchry. Engineer, J. Greene.

East Angus, Que.
Tenders will be received until 4 p.m., June 28th, by R. C. Desrochers, Department of Public Works, Ottawa, for the installation of interior fittings for the Post Office. Plans and specifications with F. A. Little, Clerk of Works, East Angus, R. L. Deschamps, Overseer, Montreal Central P. O., and at the Department, Ottawa.

London, Ont.
T. F. Flynn, 550 King Street, will receive tenders until June 19th for the erection of three frame cottages.

Ottawa, Que.
Tenders on the erection of a residence on Powell Avenue will be received until June 18th by A. R. McMonagle, 133 Bank Street. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $9,000.

Quebec, Que.
Lavoie & Frere, 56 Jeanne D'Arc Street, have commenced the erection of a residence on Aberdeen Street, estimated to cost $16,000. Brick and concrete block construction, concrete foundation, felt and gravel roofing.

E. Thivierge, 94 St. Ambroise Street, has let the general and carpentry contracts in connection with the erection of a residence to A. Deslauriers, 400 St. Francois Street. Work has been started.

Rocanville, Sask.
G. Beattie, Secretary to the Cambridge Rural Telephone Company, Limited, will receive tenders until June 19th for (1) labor and material, and (2) labor only, required in the construction of the Company's system. All work to be done according to the plans and specifications of the Saskatchewan Government.

Sandwich West Township, Ont.
Tenders on the construction of two bridges on Huron Line will be received until June 18th by Ernest Bondy, Loiselleville, Ont., Clerk to the Township Council. Concrete construction.

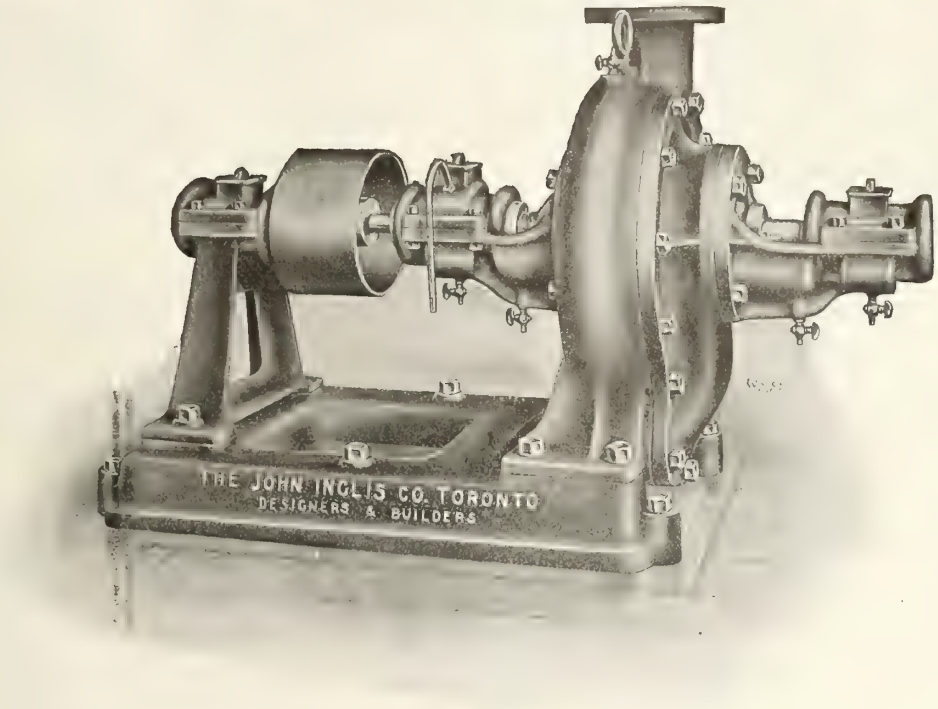
St. Catharines, Ont.
The Chairman of the Board of Works will receive tenders until June 24th for the construction of 17,500 yards of bitulithic or asphaltic concrete paving, 11,200 yards of creosoted wood block, 1,000 yards of vitrified wood block, 15,500 lineal feet of concrete sidewalk and curbs, and 4,000 feet of concrete sidewalk only. Plans and specifications at office of the Engineer, W. P. Near.

Sudbury, Ont.
Tenders on the erection of a store and garage on Elgin Street for Mrs. R. Burns, 214 Elm Street, will be received until June 18th by Angus & Angus, Architects, 9 Cochrane Building. Plans and specifications for ornamental iron work at office of MacLean Daily Reports, 25 Charlotte Street, Toronto. Approximate cost, $12,000.

Wapella, Sask.
R. F. Riddell, Secretary to the Great West Rural Telephone Company, will receive tenders until June 26th for the construction of about 7 miles of telephone extensions. Work to be done according to plans and specifications of the Saskatchewan Government.

Lining for the new intake tunnel bored under the bed of Lake Erie for the water supply of the city of Cleveland, Ohio, will consist of concrete blocks. This new tunnel is 16,000 feet long and 10 feet in diameter, extending out from crib No. 4 (1 1-3 miles from shore) to crib No. 5 (about 4 miles from shore). About 300 feet of the tunnel has already been constructed with a lining of four rings of brick.

PUMPS



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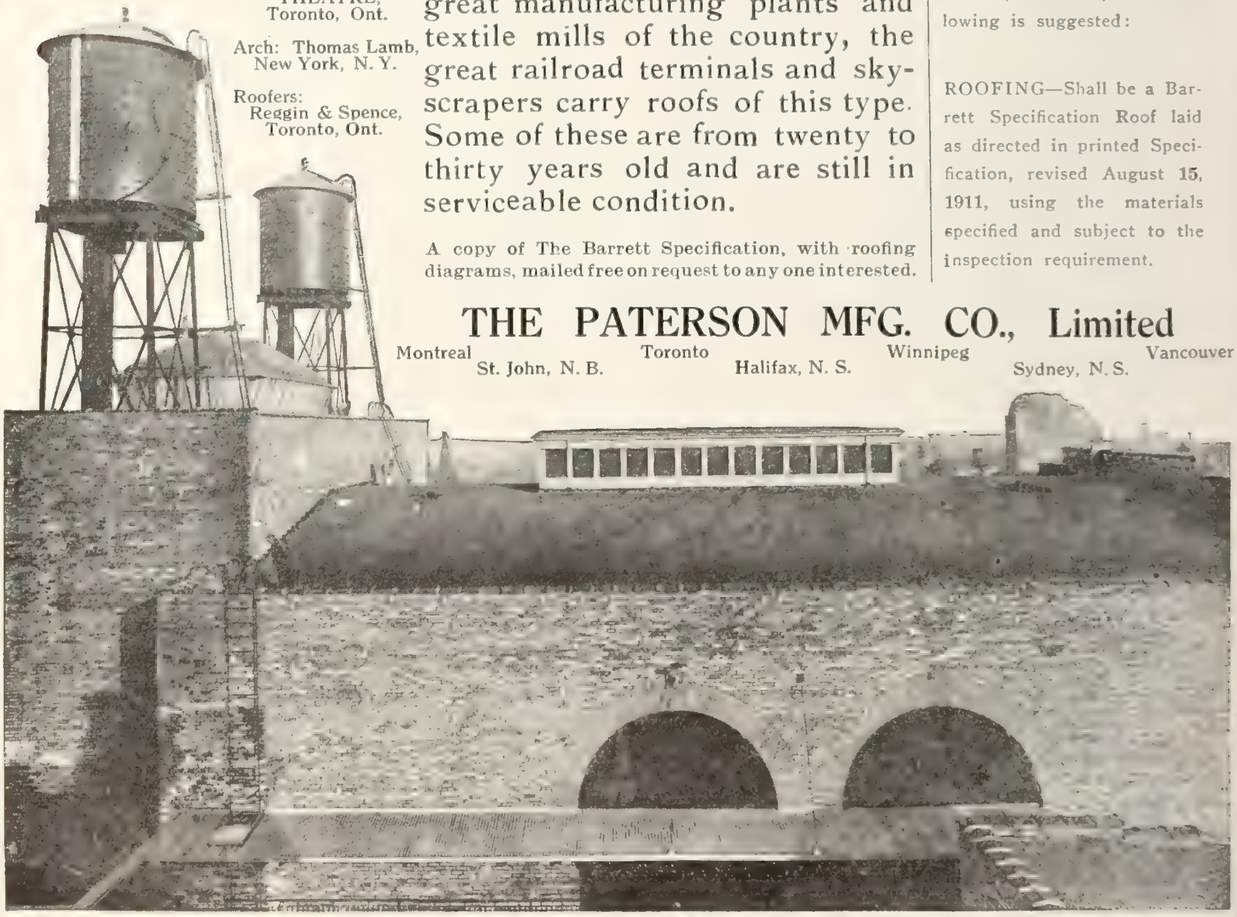

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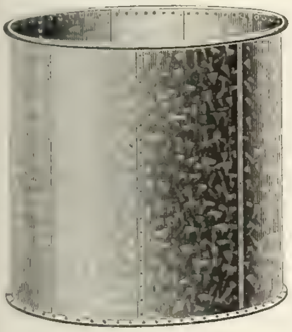

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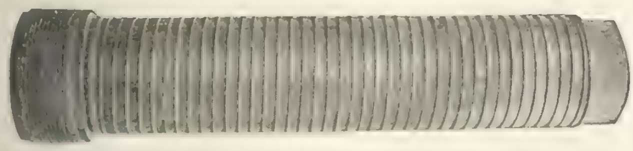

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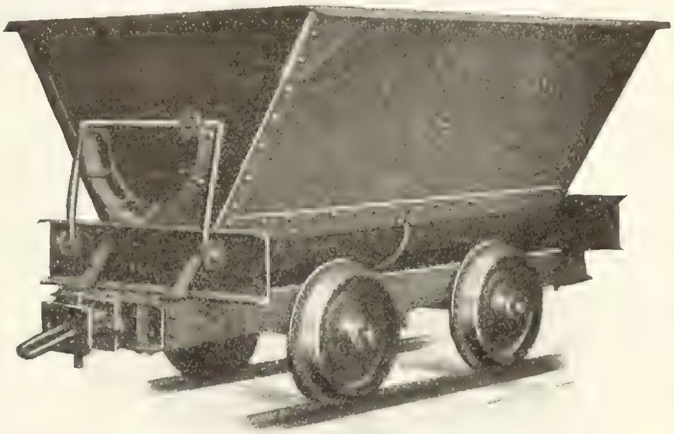

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British & Foreign Building Stones, by John Watson, Published in 1911 at the University Press, Cambridge, England. 483 pages. Price 50 cents.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

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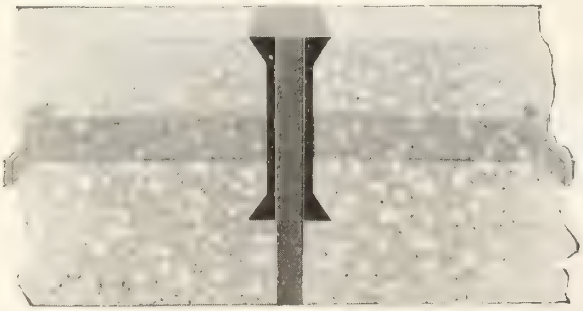

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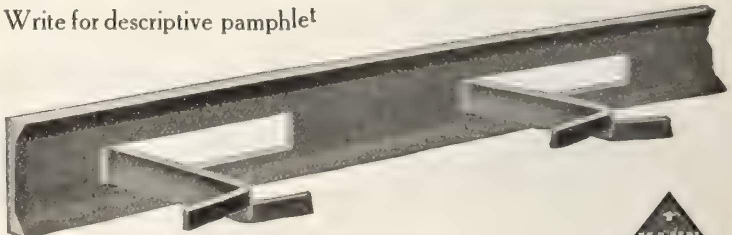

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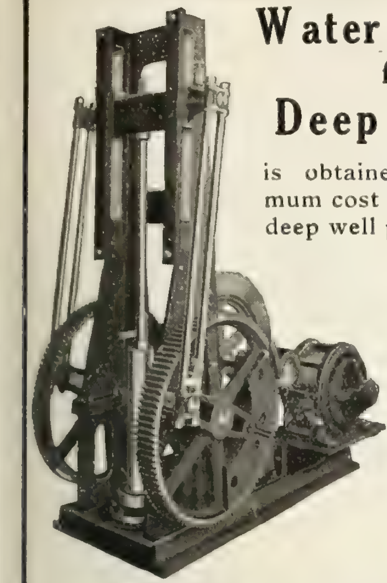

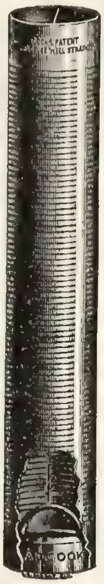

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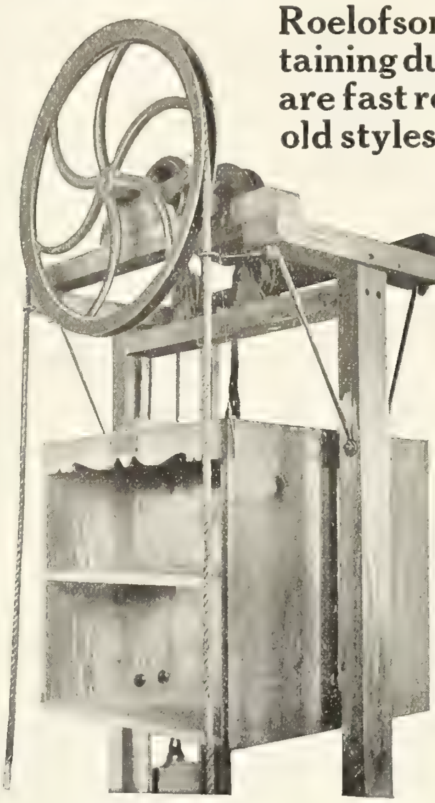

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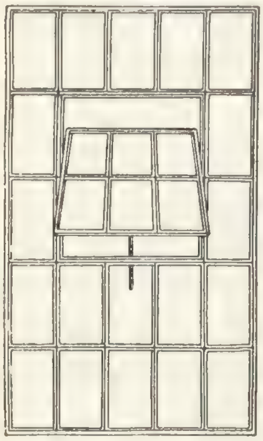

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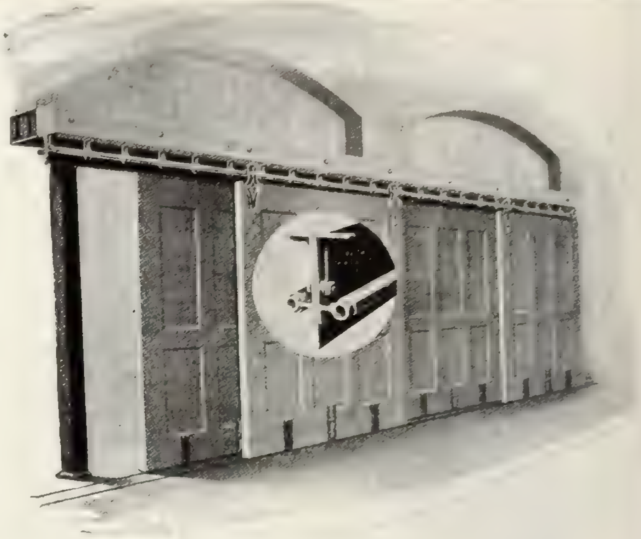

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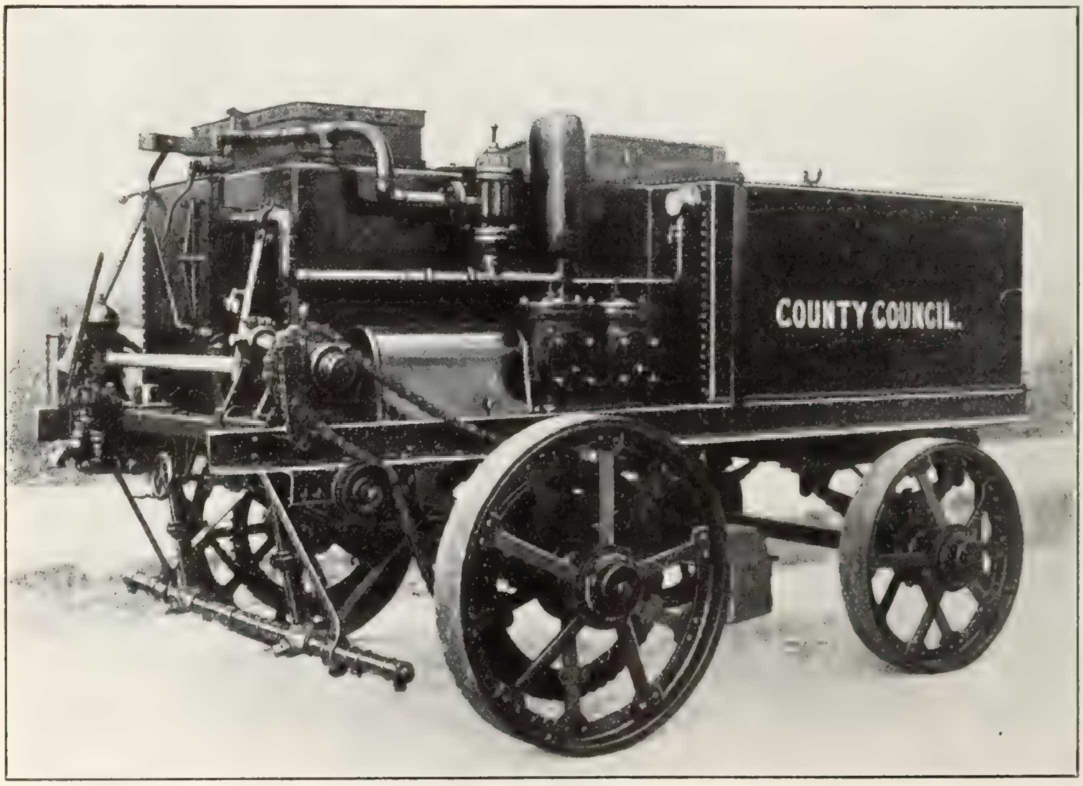

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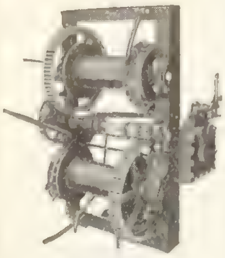
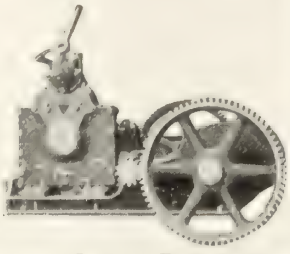


Motor Crab



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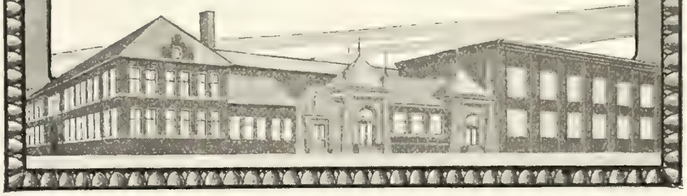

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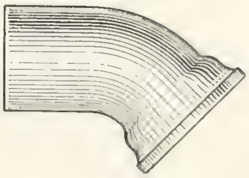

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For fifty-eight years we have manufactured the best quality of cast iron pipe.

Information and prices on request.

Warren Foundry and Machine Co.

11 Broadway - NEW YORK

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5 barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick. local, $12 to $20, imported, $20 to $30; sand lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12 in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.50; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x ¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. yd. net cash. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $5.05 per 100 lbs.; Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15½c basis per pound; British manilla, 13c basis; African hemp, 13c; sisal rope, 10½c basis; lath yarn, 9¾c. Boiled linseed oil—in barrels, 82½c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

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Plain Round, Square and Cold Twisted Squares

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The Iona Gypsum Co., Limited

Head Office, Sydney, N. S. *Mills,* Iona, N. S.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 30 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $25; fire clay, $12 per ton.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $5.35 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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We manufacture in Canada roofings of all sorts. We make roofings for factories, ready roofing or built up roofing, also asphalt shingles.

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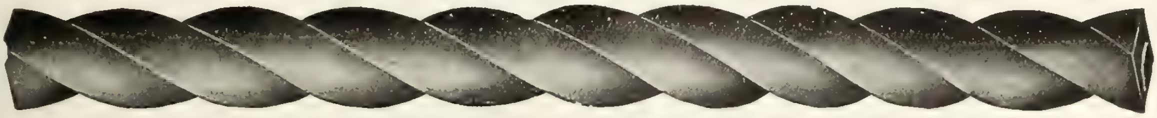

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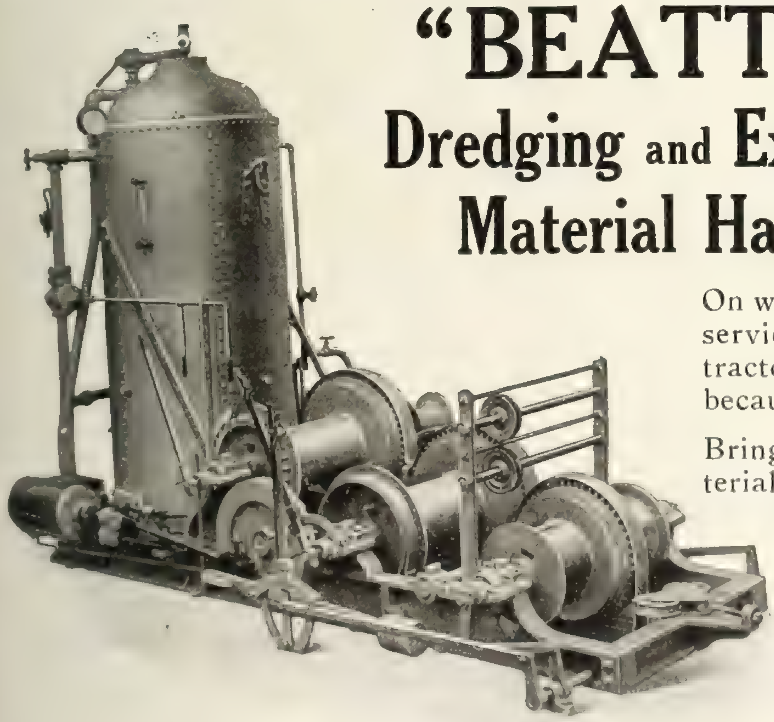

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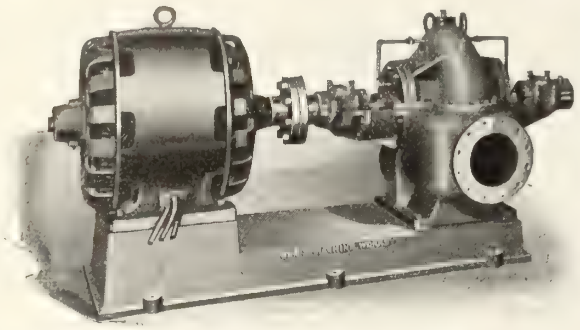

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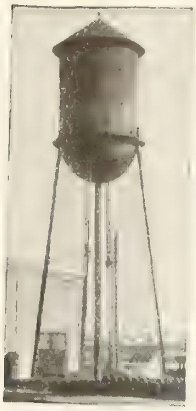

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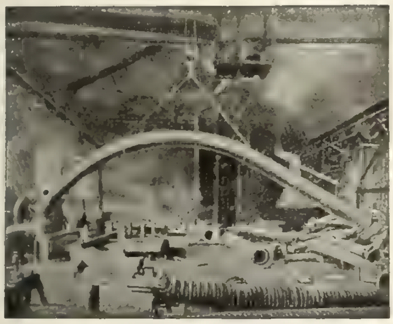

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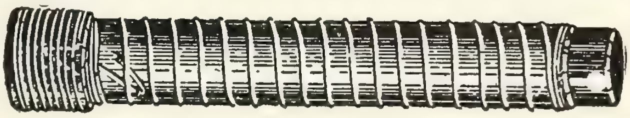

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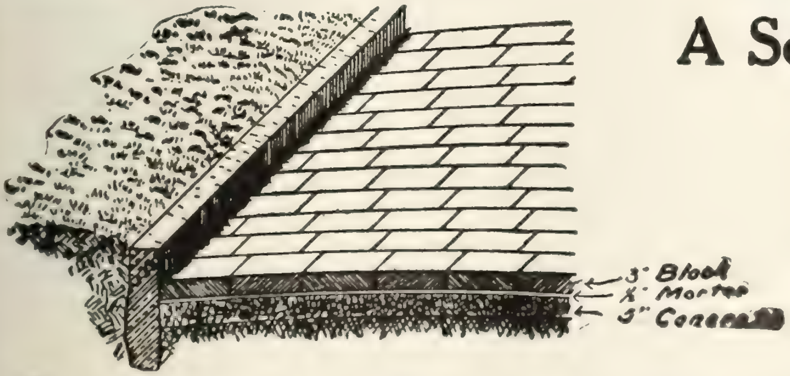

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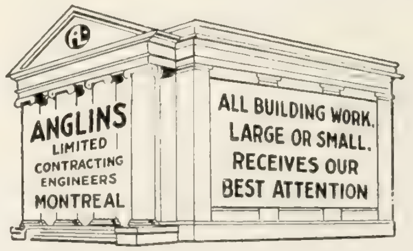
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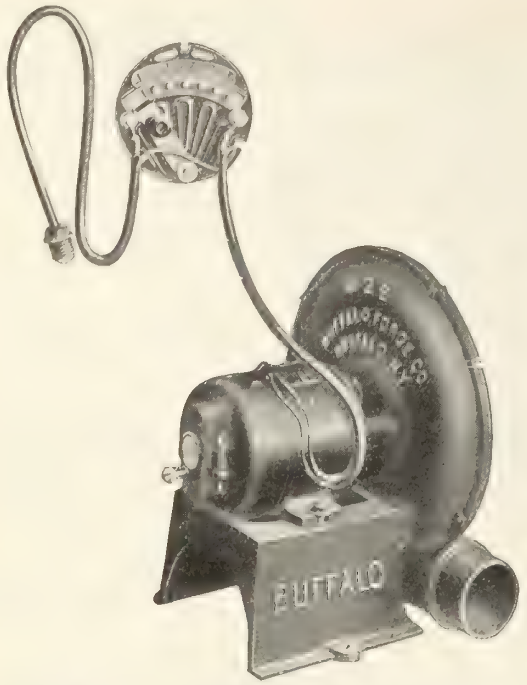

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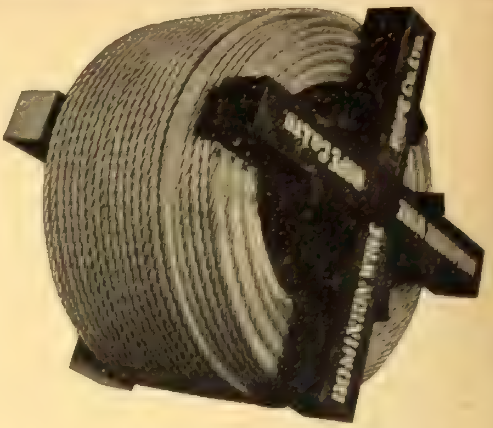

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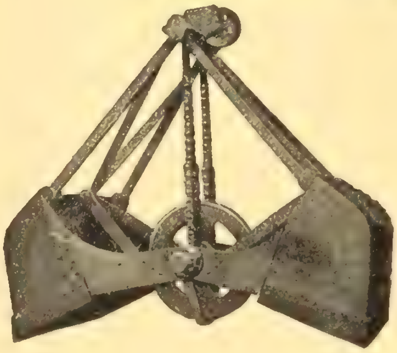

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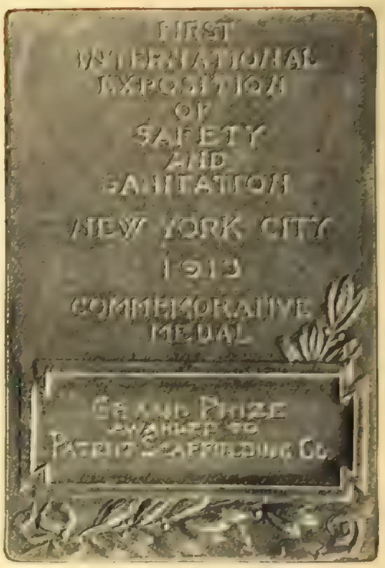
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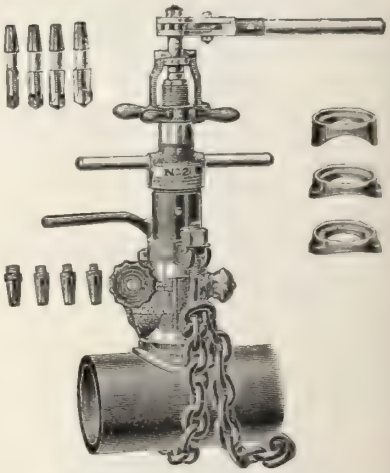

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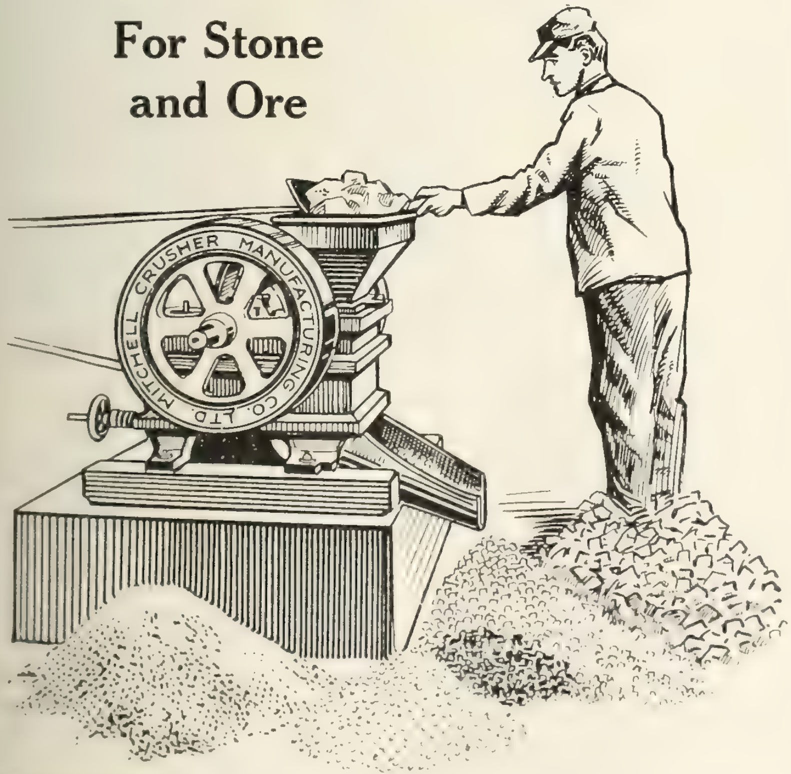
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Hopkins & Co., F. H.

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Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Lecky & Collis.

Drill Steel Sharpeners
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Tiffin Wagon Co.
Watson Wagon Co.

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Ormsby Company, A. B.
Pedlar People Limited
Steel & Radiation Limited
Trussed Concrete Steel Co.

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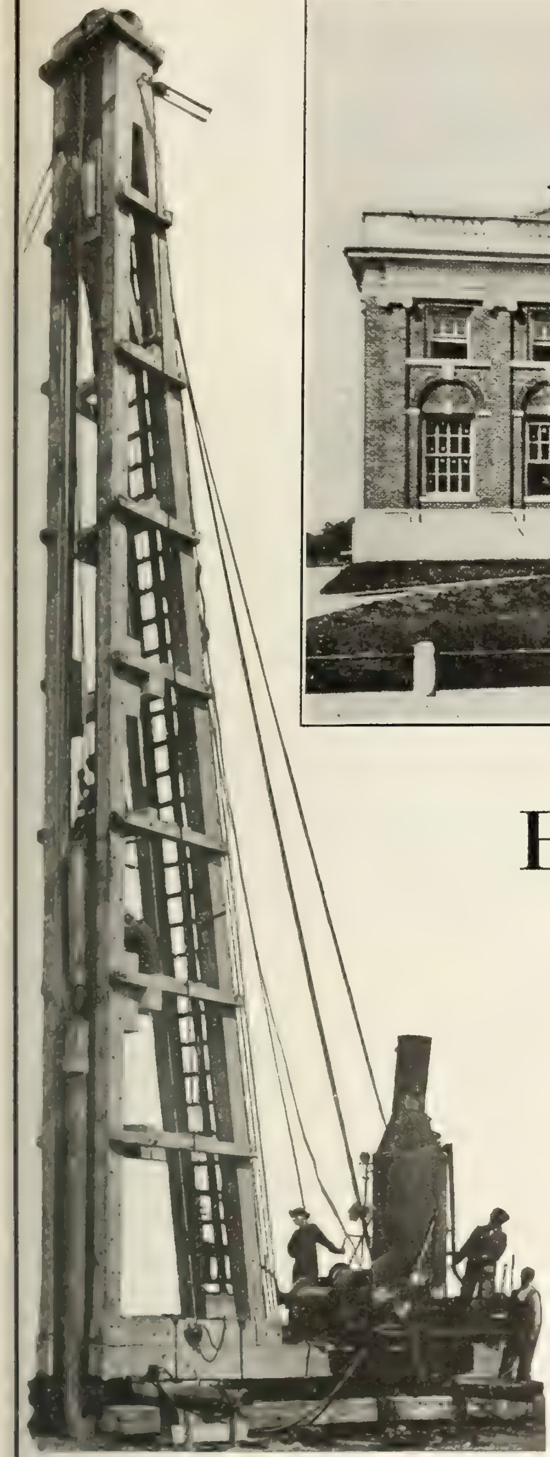
Marietta, O., U. S. Post Office



Eleven Years' Prestige Backs Simplex Piles

Simplex Concrete Piles passed the experimental stage over eleven years ago. The photograph shows one of the early Simplex jobs for the United States Government. Since that time Simplex Concrete Piles have been put under about a thousand structures throughout the world, some of them of the greatest importance.

The heavy Simplex form drives down until it rests firmly in hardpan, and in doing so compresses the earth powerfully and **evenly** from the top of the pile right down to the point. It does **not** rely mainly upon great compression of the **top** soil, which will eventually subside and allow the building to subside with it.

Write for a copy of our 96 page illustrated book on Concrete Piling. It tells why

Simplex is

the most practical system of placing in the ground straight cylindrical Concrete Piles to suit any condition of soil and loading. Simplex Piles can be easily reinforced to any desired extent; have the greatest sectional area and they **drive to Firm Footing.**

Made in three styles—the Standard Simplex, the Premolded Inserted Simplex and the "Composite" (in combination with Wooden Footing Piles).

Simplex Concrete Piling Company of Philadelphia

Canadian Representatives

Simplex Construction Company, Limited

Coristine Building, MONTREAL

"Simplex Piles Drive to Firm Footing"

Fig. C 21. Mantel Clock

ARTISTIC MERIT

as well as accuracy in Time-keeping is embodied in all Pulsynetic Electric Clocks. No matter whether they are to be fixed in the Residence, Office, Factory, Warehouse, or Tower, we have the correct design at the right price.

One master transmitter controls any number of dials, irrespective of size or position and never wants winding.

Architects, Engineers and all interested in Correct Time should send at once for our Book Five, or full particulars and prices may be obtained from:—

W. Ashall
442 Sherbourne St.
TORONTO

Gent & Co., Ltd.
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Cables, Lodestone

KERR

Gate Valves
and
Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO

Molds for Casting

Waterproof Hollow Cement Building Blocks

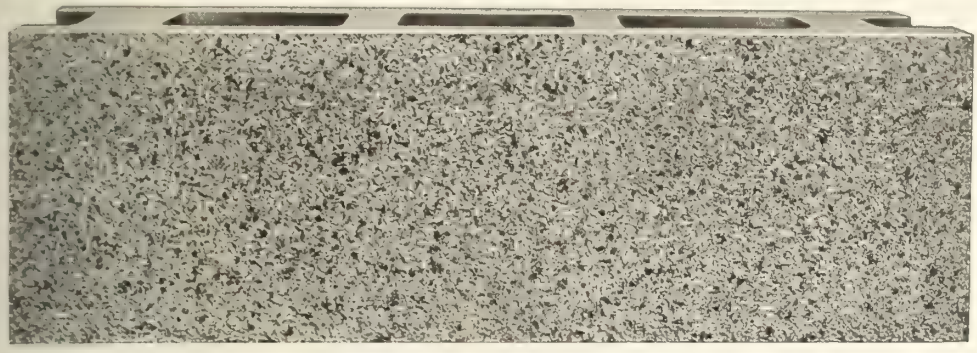
With Granite Faces

THEY COST LESS — THEY SELL FOR MORE

YOU SELL MORE OF THEM

8 x 8 x 24 inch Granite Rock Face Block

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited (Zagelmeyer System)

298 Howard Avenue, WINDSOR, ONTARIO

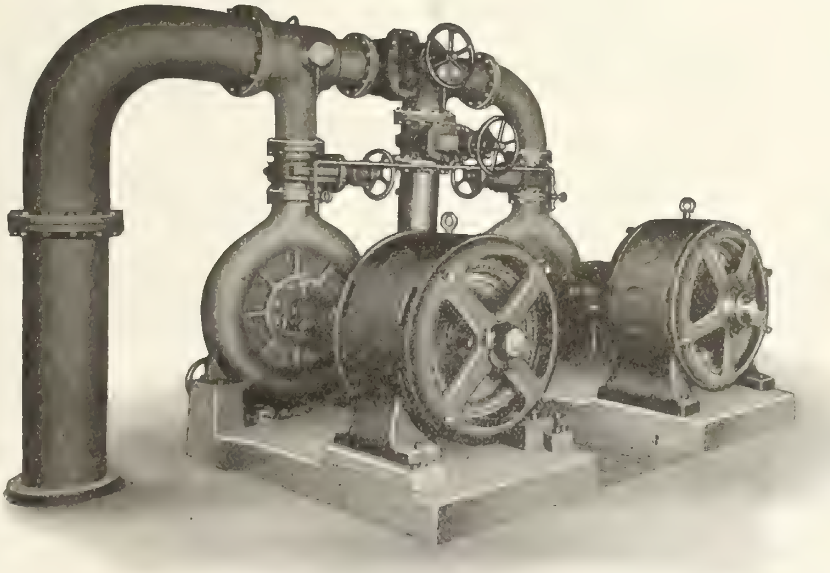
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Fig. 1
Hoist showing lower block in position for regular or slow speed.

Aikenhead's

Spiedel Chain Hoist

One man with an eight-ton hoist can lift 16,000 lbs.

These hoists are best from the standpoint of efficiency, speed and price.

When used to only half capacity, speed is doubled by locking one of the lift chains.

Made in various sizes, with safe working capacity of 1,000 to 40,000 lbs.

Store open Saturdays till 5 p.m. other days till 6 p.m.

Aikenhead Hardware Limited
17 Temperance St., TORONTO, Can.

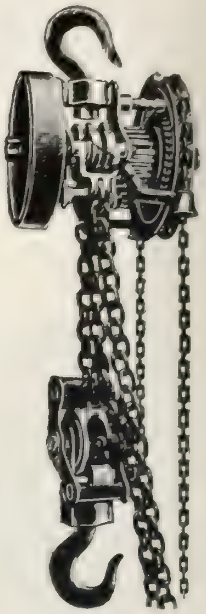


Fig. 2
Hoist showing lower block in position for fast speed.

"KINGSTON" Clams and Grab Buckets

Combine simplicity and solidity of construction with strength of material making them suitable for all classes of construction. Where difficult material is to be handled and continuous operation essential the "Kingston" will prove reliable and efficient.

Write for our Catalogue

Manufactured by
Rose, Downs & Thompson, Ltd.
Hull, England
Designers and Manufacturers of
Dredging and Oil Mill Machinery

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Hull Iron & Steel Foundries, Limited

Head Office and Works - HULL, QUEBEC

Manufacturers of Steel Castings

Chrome, Manganese and Nickel Steel Castings

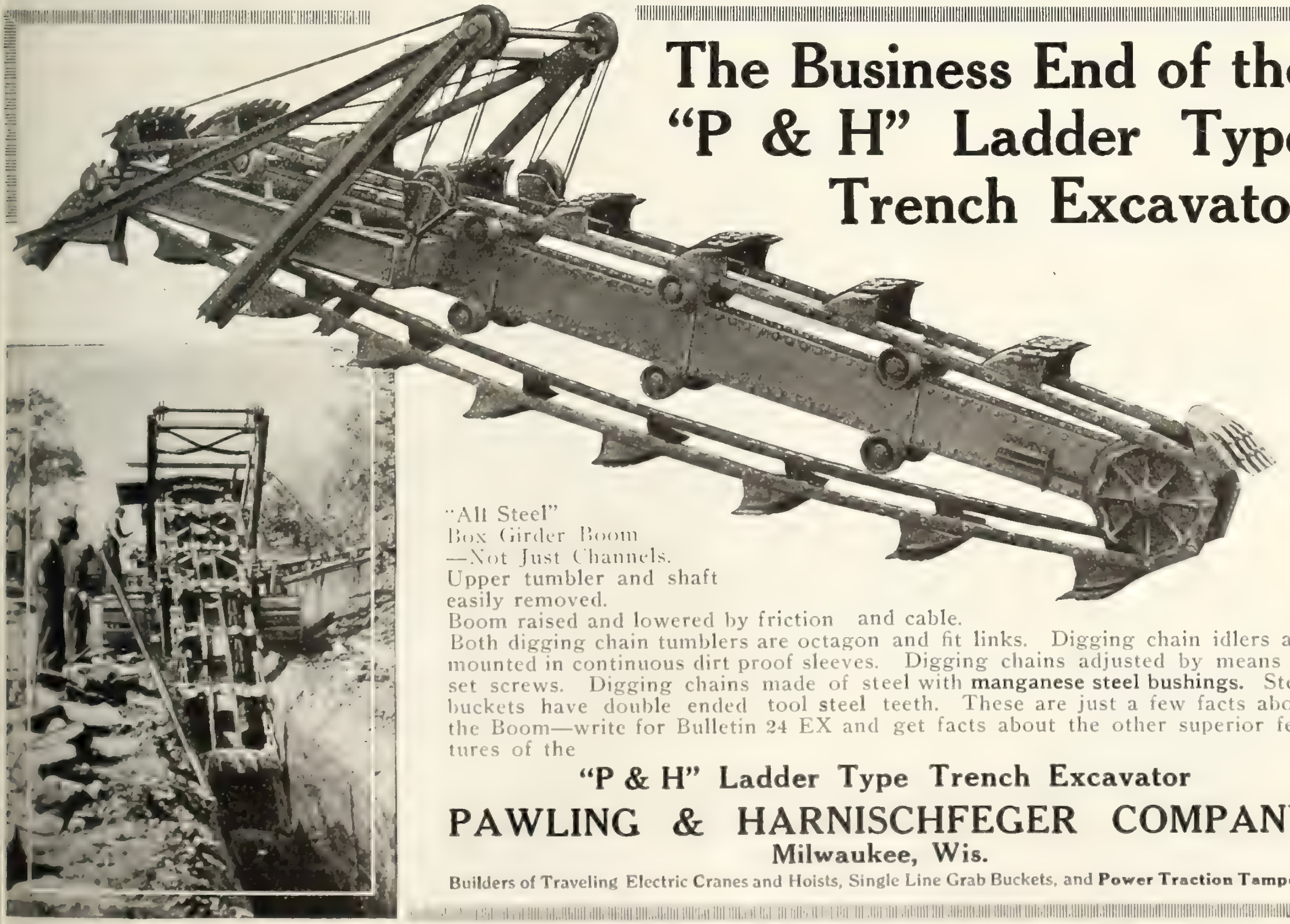
Annealed and Unannealed

Repair parts for Stone Crushing Plants, Mining Machinery and Cement Mills our specialty.

Machine Moulded Gears

any size up to 18 feet in diameter made without patterns.

We solicit your patronage and prompt attention will be given to any orders.



The Business End of the "P & H" Ladder Type Trench Excavator

"All Steel"
Box Girder Boom
—Not Just Channels.
Upper tumbler and shaft easily removed.
Boom raised and lowered by friction and cable.
Both digging chain tumblers are octagon and fit links. Digging chain idlers are mounted in continuous dirt proof sleeves. Digging chains adjusted by means of set screws. Digging chains made of steel with **manganese steel bushings.** Steel buckets have double ended tool steel teeth. These are just a few facts about the Boom—write for Bulletin 24 EX and get facts about the other superior features of the

"P & H" Ladder Type Trench Excavator

PAWLING & HARNISCHFEGER COMPANY

Milwaukee, Wis.

Builders of Traveling Electric Cranes and Hoists, Single Line Grab Buckets, and **Power Traction Tampers.**

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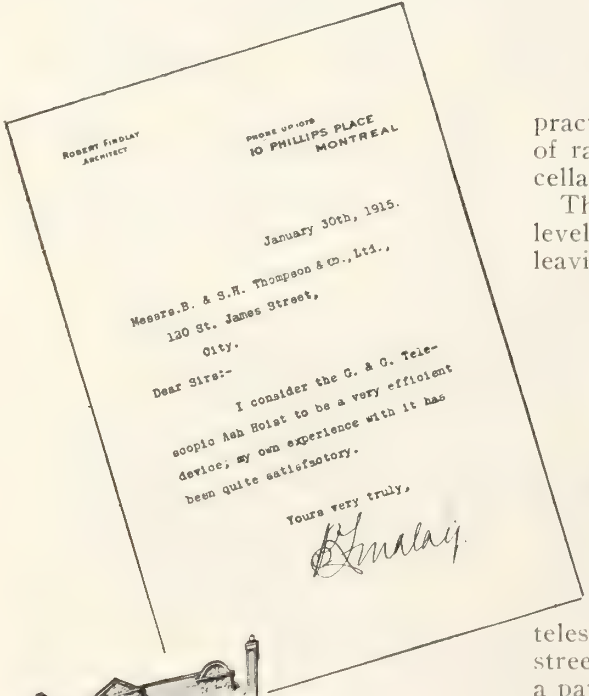


ROBERT FINDLAY
ARCHITECT

PHONE UP 1078
10 PHILLIPS PLACE
MONTREAL

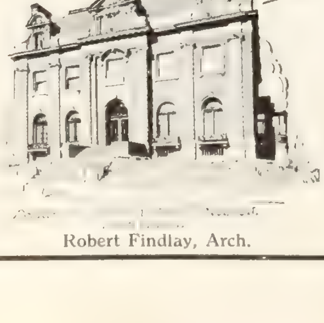
January 30th, 1915.

Messrs.B. & S.H. Thompson & Co., Ltd.,
130 St. James Street,
City.

Dear Sirs:-

I consider the G. & G. Telescopic Ash Hoist to be a very efficient device; my own experience with it has been quite satisfactory.

Yours very truly,
RFindlay



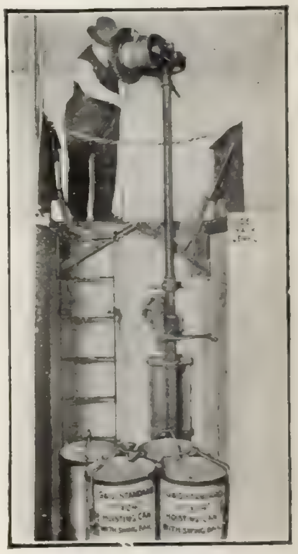
Robert Findlay, Arch.

A "One-Man" Ash Hoist

The G. & G. Telescopic Hoist is so designed that it is practical for one man unaided to perform the entire operation of raising ash cans to sidewalk and lowering empty cans to cellar.

The operator standing at sidewalk level can raise 4 or 5 cans without leaving the sidewalk.

The G&G PATENTED Telescopic Hoist
with compound gear and brake attachment



Raises a maximum load of 500 lbs. at a guaranteed speed of 30 feet per minute.

When not in use, hoist telescopes and no part shows above street level. This hoist is fitted with a patented "silencer," making it absolutely noiseless in operation. It can be installed in any building, old or new.

Write to our nearest agent for booklet and prices **"Made in Canada"**

GILLIS & GEOGHEGAN, Sherbrooke, Que.

Black Building Supply Co., Ltd. Agents for Ontario **Toronto**
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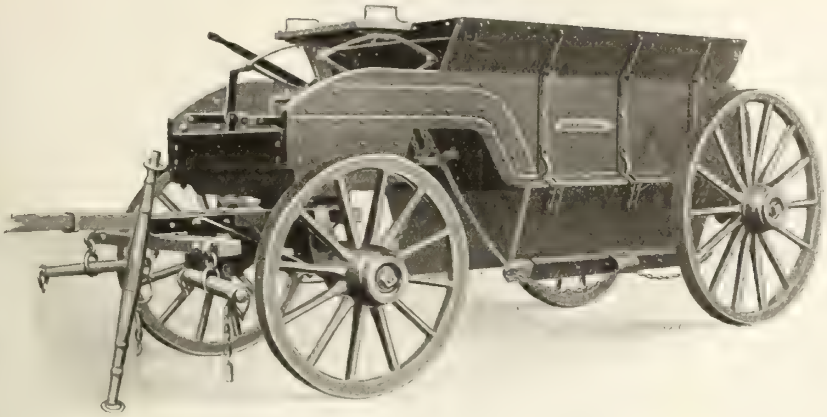
Wm. N. O'Neil Co., Ltd. Agents for British Columbia **Vancouver**
W. T. Grose, Agent for Manitoba, Saskatchewan, Alberta, **Winnipeg**

"MADE IN CANADA"



The "CHAMPION" Dump Wagon

Champion Road and Contractors Outfits
A complete and varied line of all machines for Road Building and Street Work

CHAMPION DUMP WAGONS

Capacities:
1-1/2 Cubic Yards.
2 Cubic Yards.

If you are looking for a good Dump Wagon, you cannot afford to overlook the CHAMPION.

Selected materials are used throughout, and very careful consideration is given to the details of construction as well as to the workmanship. We can guarantee the **Champion** Dump Wagon to do what any other Dump Wagon will do and "do it longer."

Detailed information and catalog upon request.

Manufactured by

American Road Machine Company of Canada, Limited
Goderich, Ontario

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Made in Canada

ARTIFICIAL MARBLE is a material manufactured by a new process. The ARTIFICIAL MARBLE is harder than natural marble, is less absorbent and is susceptible to a higher finish. The coloring is non-fading and runs entirely through the marble.

ARTIFICIAL MARBLE is polished (not varnished) in the same manner and with the same material as natural marble.

ARCHITECTS:—Patronize a home industry and specify ARTIFICIAL MARBLE made by a Canadian firm, and with Canadian material.

We manufacture ARTIFICIAL MARBLE in all the beautiful colorings of the Italian, Greek, French and Belgian marbles, and the well known Canadian and American marbles, and our facilities are adequate to turn out the largest contracts.

Specify ARTIFICIAL MARBLE and avoid delays caused by the unsoundness of natural marble quarries.

Manufactured by

J. E. CARREAU

Office and Factory, 13 Notre Dame St., East
Phone Main 5539—Connecting All Departments
MONTREAL

CRUSHED STONE

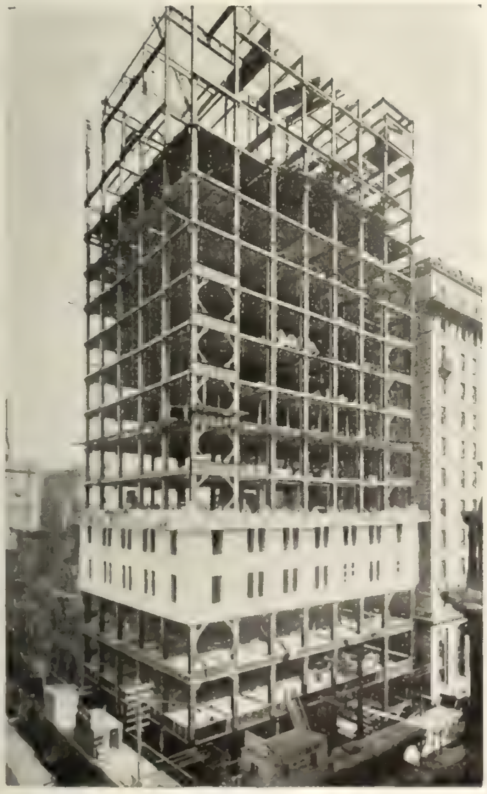
Good Roads Making Good
by using

Dundas Stone

Best by Test

Canada Crushed Stone Corporation, Limited
DUNDAS, ONTARIO

Toronto Agents:—Rogers Supply Co., Limited, 38 King Street West



Canadian Pacific R. R. Office Building
Dominion Bridge Co. Steel Fabricators
Structural Steel Painted with
"SUPERIOR GRAPHITE PAINT"

The Structural Steel of
The Highest Commercial Buildings
in the British Empire
are protected by

"SUPERIOR GRAPHITE PAINT"

The use of this Paint absolutely insures steel against damage by Rust or Electrolysis.

SPECIFIED BY LEADING ARCHITECTS

Because it has Twenty-five years of **proven** service to its credit.

Made only by

DOMINION PAINT WORKS, LIMITED
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Toronto
WALKERVILLE, ONT.
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Made in U.S.A. by DETROIT GRAPHITE CO., Detroit, Mich.

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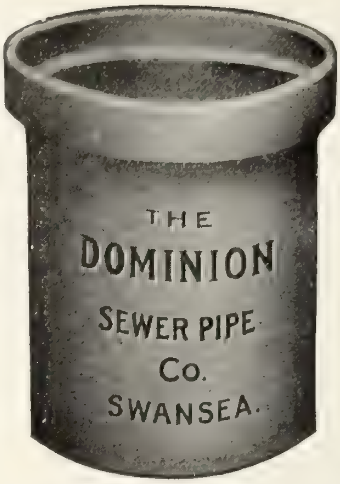

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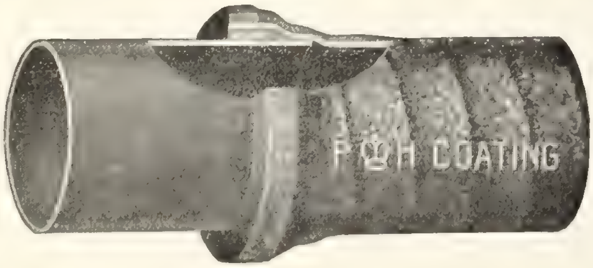

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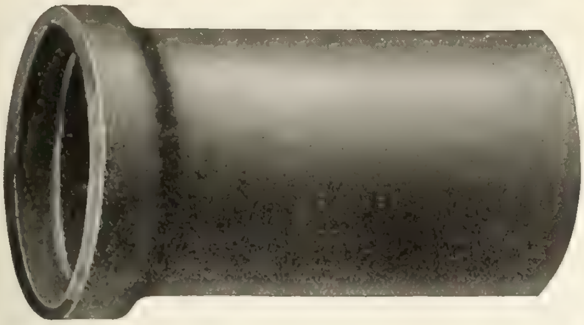

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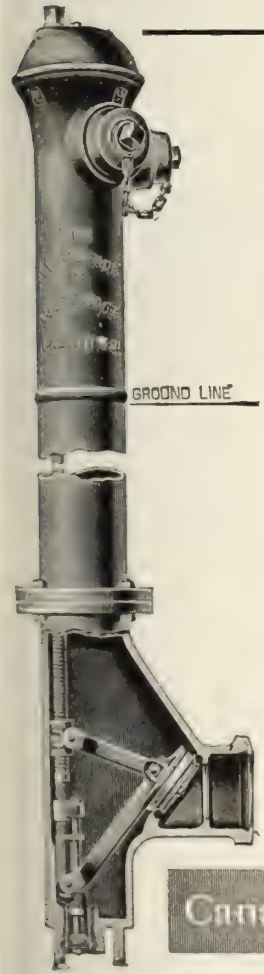

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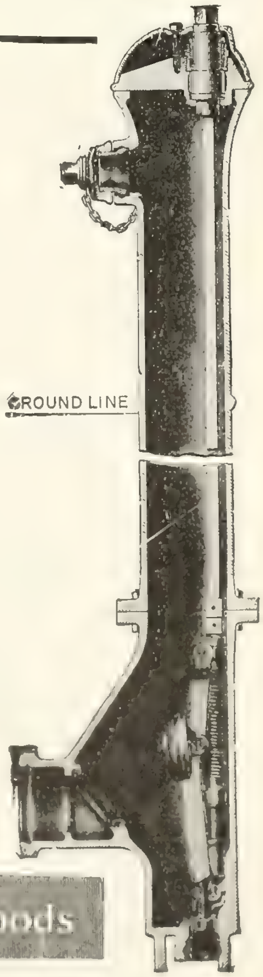

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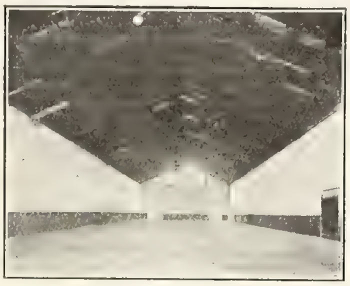

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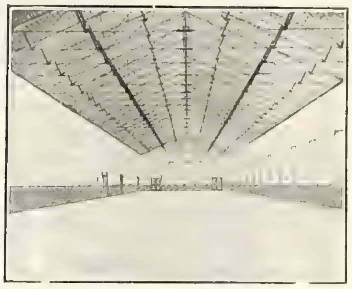

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Inspection on Building Construction

ONE'S attention is drawn to the position of responsibility of the architect or engineer in relation to his client by several recent decisions of the courts in which heavy damages have been awarded the client against the architect for faulty work on the part of the contractor. One can hardly question the correctness of the attitude of the courts in regard to this matter. While the architect may feel that there is a large element of injustice in holding him responsible for another's work, it must be conceded that the court is in a much better position to take an impartial attitude than an architect or engineer can be. Quite naturally, when a man retains an architect to look after his interests, and pays him a fee for this purpose which to the client nearly always seems a large one, and the results are not satisfactory, the architect is the one whom the client holds responsible—and certainly it is the duty of the architect to do everything possible to ensure that the work on the building shall be done properly.

It becomes necessary, then, for the architect, in order to protect himself from liability for damages, to take such steps as are necessary to obtain satisfactory construction. First, he must make certain that the plans and specifications have been prepared properly, which is a matter altogether in his own hands. Most of the recent actions for damages have been in cases of reinforced concrete buildings. An architect is taking a great risk in having concrete or steel framing plans prepared by any one except a man who he knows is competent to do such work. However, it is in the construction rather than in the design of such buildings that the fault has lain, and generally the architect has been blameworthy only because, through his neglecting to give proper inspection, the contractor has been allowed too much latitude in his work.

It devolves upon the architect or engineer, therefore, to employ such means of looking after the work that it will be impossible for even a dishonest contractor to do his work improperly. In the case of ordinary construction the general supervision as ordinarily given by the architect should prove sufficient. Nearly all the materials, such as stone, brick, lumber, and so forth, are either natural products or are manufactured before being brought to the building, and their quality can be ascertained by an ordinary examination. The quality of the workmanship also can be determined fairly well by an inspection after the work is done. In the case of steel work the architect is not taking any very big chances by not having the steel inspected at the rolling mills. The manufacturers aim to make a steel of uniform quality, and, while some rollings do not come within the limits of their standard, they vary so little from them that even the poorest steel rolled into structural shapes is quite good enough for use in ordinary structures. In larger and more important buildings, however, the steel should be inspected at the rolling mills, in the fabricating shops, and on the building.

In the case of concrete, both plain and reinforced, which has become so important in construction in recent years, the material is manufactured from its ingredients right on the work. The quality of the sand and stone can be determined by ordinary observation. The quality of the cement can be determined only by laboratory tests. While the cement manufacturers, like the steel manufacturers, aim to make a standard material, they are not so successful in coming within or close to the limits of their standard.

Some of the cement turned out by the factories is quite unfit for use; so that in all but the most unimportant work the cement should be tested.

Concrete is made in small batches, there being perhaps several thousand in an ordinary sized building. Any single batch, improperly mixed, could cause the collapse of a portion of the building. These batches are mixed and made by laborers who know nothing of the importance of having the proper proportions of ingredients. It is imperative, therefore, that a man be constantly at the machine to see that each batch is accurately proportioned and mixed. It is imperative also that a man be on the building where the concrete is being placed to see that the forms are constructed properly; that all dirt is kept cleaned off the forms and previously poured concrete; that the steel is properly placed and secured; that the concrete is puddled properly into the forms and around the steel—in short, to see that the concrete columns and beams are fabricated in an efficient manner.

It is evident that such inspection as this is quite outside the work meant by the term "supervision" as used by architects and engineers. Since it is extra work occasioned by the use of a special material, and work that would not be required by the ordinary forms of construction on which the scale of architects' fees has been based, it should be paid for by the owner.

In the case of inspection of steel work it is the practice of some architects to specify that the steel contractor shall pay the cost of the steel inspection, and to appoint one of the inspection companies to do the inspection. This could be done in the case of concrete construction also. The more satisfactory way, however, would be to make an addition to the regular commission, explaining to the owner why it is made and the necessity of it. In most cases an addition of one per cent. to the ordinary commission will be more than sufficient to cover the cost of such services.

If, in spite of this most careful provision for inspection, the building turns out to be faulty, and the design is correct, it must be on account, not only of dishonesty on the part of the contractor, but also of dishonesty, or negligence (which amounts to the same thing), on the part of the architect's own employees.

Awarding Municipal Contracts

IN Montreal there has been considerable trouble in connection with the city's awarding a contract for asphalt paving material to a firm other than the lowest tenderer, and, apart from the judgment given, the statements of the Judge have considerable interest as bearing on the motives which should actuate councils in awarding contracts.

Pointed criticism of the action of the Board of Control was made by Chief Justice Archibald when confirming the interim injunction entered by Charles P. Dubuc to restrain the city from making the contract for a year's supply of asphalt which, by a resolution of the Board of Control, had been awarded to the Aztec Oil and Asphalt Refining Company. While the petitioner, Dubuc, is the agent for John Baker, Jr., of New York, who had tendered for the supply of asphalt till the end of the current year at a lower figure than the Aztec Company, his injunction was entered as a ratepayer, alleging that the Board of Control had exceeded its jurisdiction, both in failing to award the original contract for six months' supply of asphalt to the lowest tenderer without showing valid reasons for rejecting the lowest tender, and also for making a subsequent agreement with the Aztec Company for a longer contract without giving other firms the opportunity to bid for this privilege.

His Lordship held that the petitioner had every right, as a ratepayer of Montreal, to take legal proceedings in this matter. In dealing with the rights and duties of municipal bodies, the Court emphasized the point that, when tenders had been called for, it was quite improper to pick out one tenderer and then make a private arrangement with him, not giving the other tenderers the same opportunity. If municipal business were to be conducted in this manner, the Chief Justice remarked, no respectable merchant would care to submit a tender, and the system would make all kinds of fraud and corruption possible. The Board of Commissioners had not in this case contracted by tender at all, and had granted something entirely outside of the Commissioners' power to grant. In considering the point that the Board of Control had proposed to extend the contract with the Aztec Company for a further period of eight years, provided the company should erect a refinery in Montreal, and that this would be recommended to the City Council, His Lordship dwelt on the inconvenience and expense that would be involved by the company if they were permitted to built the refinery in accordance with the contract and should perhaps be told later that the contract was illegal.

As regards the right of the Board of Control to reject the lowest tender, the Chief Justice held that such discretionary power could not legally be exercised unless the Board could show valid reason for not accepting the lowest tender.

The interim injunction having been confirmed, the case will be heard on its merits in the Superior Court; Arnold Wainwright, K.C., for the petitioner, F. H. Markey, K.C., for the Aztec Company, and P. E. Lamarche, K.C., for the city.

Building Our Cities

THE credit and progress of a city is based on the values created in the city, and there can be no doubt that its buildings are a city's most important asset. Our having paved streets, water-works, and other public utilities is only incidental to the fact that we have improved certain lands by erecting and establishing thereon our homes and places of business. Therefore the manner in which we build for and house and employ our people should be our first consideration.

In the upbuilding of our cities we find the enforcement of regulations governing the erection and maintenance of buildings a sadly overlooked quantity—simply because, however capable and conscientious a building inspector may be, he can enforce only what the people will submit to.

A building inspector may be, and usually is, an expert in his line, but should he exercise even ordinary courage in the performance of his duties he soon finds himself in conflict with a baker or a laundry man who happens to be in a particular situation by the accident of a few votes. Added to the other difficulties that we encounter is the fact that the courts have and do decree that the enforcement of all laws is distinctly and entirely within their jurisdiction and interpretation of the circumstances, and the writer can recall instances where Judges reserved their decision on the violating of a building by-law until they had viewed the premises, and then based their judgment on their personal knowledge of building construction—of which usually they are as innocent as a child is of the solar system. The Government is as responsible for the conditions under which our cities are built and our people are housed and employed as it is for the charters under which our cities are governed.

Many people will pay two dollars to keep a fifty-cent dog, and at the same time argue that it is not the city authorities' business even to suggest an improvement in the maintenance of buildings. The result of this is that insurance rates are excessive in all our western cities, and so it will continue until we can bring the public to realize the conditions we are creating.

The Purification of Sewage by Aeration

By R. O. Wynne-Roberts*

In this article I will endeavor to describe the most recent method of treating sewage, which gives promise of great improvement on the measure of purification at present obtainable in the better managed sewage treatment works. In popular parlance, the new method consists in blowing air into the sewage until the carbonaceous and nitrogenous matters have not only been rendered innocuous and stable, but the residual sludge has also been converted into a good fertilizer.

At first glance the process may be thought simple and easily applied, but when it is examined carefully it will be found to involve some new problems which have not been encountered hitherto in this connection. It involves a bio-chemical investigation—for the purification of sewage is allied to biology and chemistry as well as physical operations, and in many respects it is not decided yet which constitutes the most important of these studies. Pneumatics and heating will be involved, as air must be supplied and distributed under the most advantageous conditions to promote thorough aeration, diffusion, and oxidation, while in rigorous climes in winter the air must be heated so as to produce the best result and maintain an equable temperature in the tanks. As cost enters prominently into this question, it will be necessary to have good management and efficiency to attain the maximum economy.

Aeration of sewage has been tried frequently during the last half-century, but the results obtained were indifferent. Indeed, many of those who experimented came to the conclusion that oxidation by this means was not practicable. Aeration of sewage has been tried under different conditions, and, while no tangible success has been met with, fresh light has been obtained, and step by step this process has been developed. One reason for the failures was the fact that the sewage, the effluent, or the filtrate was treated on a continuous flow, and the oxygen had not time to effect any appreciable changes. The prolonged experiments made by the Massachusetts State Board of Health at Lawrence have been the means of throwing light on many obscure changes, and latterly Messrs. Clark and Gage endeavoured to promote the oxidation of sewage by an abundant growth of green algae, which, as is well known, imparts oxygen to the polluted waters in which it is found.

Among the experiments made by Messrs. Clark and Gage the most interesting and instructive in this connection was one conducted in a small tank containing horizontal layers of roofing slates kept about one inch apart. Later on another experiment was made in the same tank with the slates placed vertically. The first was similar to Dibdin's slate beds, and the second similar to the colloidors in a hydraulytic tank or Martin's cellular tank. The primary object was to observe the effect of algae growth, combined with the blowing of air into the sewage, and the results were good.

Whilst researches were being made at Lawrence, Mass., others were being conducted at Manchester, Eng. The first experiment was made by inoculating sewage with a specific organism which has the power of precipitating iron as ferric hydroxide from solutions of iron salts. Dr. Gilbert Fowler and Capt. Mumford succeeded in clarifying and purifying sewage by this means when the sewage was aerated. The next development was made by Messrs. Ardern and Lockett, also at the Davyhulme Sewage Disposal Works, Manchester. Instead of trying to aerate a continuous stream of sewage or effluent, a sample was aerated until all the organic matter was oxidized, which took over a month to do—clearly indicating that before any tangible results from aeration can be secured certain conditions, which will be discussed later on, have to be obtained. After the sludge had been allowed to settle the clarified liquid was decanted and more fresh sewage was added. Air was again blown in until the mixture had been oxidized, which took place in less time than in the previous experiment. By repeating the operation of decanting the clarified liquid and adding more sewage until the quantity of sludge had accumulated to about twenty per cent. of the capacity of the vessel, it was found that the time required to purify the sewage diminished from five weeks to five hours.

Having succeeded in finding out what were the essential conditions of this process, Messrs. Ardern and Lockett tried the experiment on a larger scale—in casks. Fortunately the adjacent city of Salford had tanks already fitted with air pipes, so that it was a simple matter to try the aeration method on a still larger working scale. The results were good, as will be shown further on.

This method of sewage treatment has attracted great attention, and will be tried at Baltimore under the joint direction of the Baltimore Sewage Commission and the United States Health Department. It is stated that Milwaukee has retained the services of Dr. Gilbert Fowler to advise the authority on experiments to be made on these lines. Dr. Edward Bartow, Director of the State Water Survey of Illinois, made some interesting experiments on these lines which were described in the technical press. Several cities in Great Britain and the United States are trying or are about to try the process, and it is interesting to note that on my recommendation the City Commissioners of Regina have started investigations into the possibilities of the activated sludge process. The sewage in two tanks, each holding about five hundred gallons, is being aerated in Regina, one by air blowing and the other by air injection. The quantity of air is measured by circular orifices, and observations will be made as to temperature, chemical changes, and so forth. In due time the results of these experiments will be known, and they will be both instructive and valuable.

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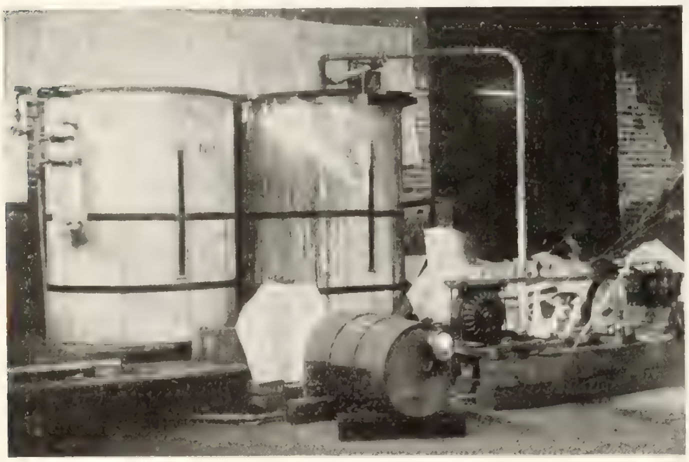
* M. Inst. C.E., M. Can. Soc. C.E., M. Am. Soc. C.E.

Having described in a simple manner the progress of the development of sewage aeration, it will doubtless be interesting to describe some of the results obtained and the deductions to be made.

At Lawrence, Mass., where, as already explained, the main object was to study the effect of green algae and aeration on the sewage treated, it was found that the heavier the green growth the clearer was the aerated sewage.

At the commencement of the test the slate bed was aerated at the rate of 200,000 cubic feet of free air an hour for every million U. S. gallons. This was blown in for twenty-four hours, but as the experiment proceeded the air supply was reduced to 100,000 cubic feet an hour to each million gallons. Afterwards the slates were placed vertically one inch apart, and air at the rate of 150,000 cubic feet an hour for each million gallons was blown in for five hours. The greatest efficiency was obtained when the sewage was aerated for ten hours with air equivalent to 200,000 cubic feet to each million gallons an hour. The average reduction in free ammonia was about twenty per cent., and the reduction in Kjeldahl nitrogen and in oxygen consumed was about 56 and 61 per cent. respectively. The reduction in Kjeldahl nitrogen during the time when the gelatinous film on the slates had been re-established was more than five times as great as when the slate surfaces were comparatively clean. When air at the rate of 25,000 cubic feet for every million gallons an hour was used for five hours the reduction of Kjeldahl nitrogen was about 56 per cent.


Plant used in the experiments in connection with the aeration of sewage at Regina, Sask.

A heavy brownish gray growth of a gelatinous consistency on the slates appeared to collect the suspended matter mechanically, and also a large part of the colloidal matter in the sewage. The clarification effected was superior to all other processes with the exception of one in which large quantities of copperas and lime were used. The smallest average removal of total and organic matters in suspension was over 77 per cent., and even when only 25,000 cubic feet of air were used the average removal was 80 to 82 per cent.

Cost.—Assuming a depth of 5 feet of sewage, electric current at four cents a kilowatt and 25,000 cubic feet of air were used an hour for every million gallons, the treatment being continued for five hours. Messrs. Clarke and Gage estimated the cost of aeration at about $1.85 for every million U. S. gallons.

The effluent from the aerated sewage was filtered first at the rate of one million gallons an acre daily, and then the rate was increased gradually to ten million gallons an acre daily. The filter was ten feet deep of broken stone ranging from two-inch to one-inch. After maturing, it was attempted to operate the filter at such a rate that the filtrate would contain about 1.5 parts to every 100,000 of nitrates. It is interesting to note that when the filter was worked at the above maximum rate the nitrate amounted to 1.33 and 1.42 parts to a 100,000, while for all rates of flow from 1,000,000 to 10,000,000 gallons an acre daily during the year 1913 the average was 1.72 parts to a 100,000.

The results of the Lawrence experiments are very instructive when taken apart from the growth of green algae. Under Canadian conditions the cultivation of algae is practically out of the question, because filters and tanks are usually covered, and algae must have abundance of sunlight.

Reverting to the Manchester experiments, it is evident from the observations made by Messrs. Ardern and Lockett that the activated sludge when once produced by aeration must be kept in intimate contact with the sewage to secure the full value of the intensified oxidation which it is capable of effecting—or, in other words, the admixture of sludge and sewage must be thorough if the work of purification is to be accelerated and increased. The period of aeration after the process has been effectively established is dependent upon the strength of the sewage, and as Canadian sewage is more dilute than at Manchester it is probable that less time will be required to oxidize the organic matters, although it is possible that for the same quantity of carbonaceous and nitrogenous matters the quantity of air and the time taken to change them may be the same in Canada as in Manchester.

In the case of experiment 8 (a) at Manchester tests were made to ascertain the difference in the efficiency of ordinary contact as compared with thorough mixing of sludge and sewage. It was found that in the latter case the purification was much greater, as is shown below:—

Reduction in four hours' oxygen absorption, 14 per cent. superior.

Reduction of free ammonia, 42 per cent. superior.

Reduction of albumenoid ammonia, 22 per cent. superior.

Increase in nitrites and nitrates, 1100 per cent. superior.

The test made at Salford was started in June, 1914, and air was blown in under a pressure of two pounds. Copperas was added four times at the rate of sixteen grains to a gallon to accelerate the process. The purification was progressive as the quantity of activated sludge was gradually accumulated, for by October, 1914, when there was about twenty per cent. by volume of sludge in the tank the purification in two hours was 91 per cent. when based on the oxygen absorption figure.

In November last, with a blowing period of three hours, the results were as follows:—

Purification based on	Best	Worst	Average
	Percentage		
Albumenoid ammonia	77	78	76
Four hours' oxygen absorption	93	81	90

In this case the air was distributed through a large number of one-eighth-inch jets, and perhaps was not diffused as efficiently as if it had been blown in through porous plates. At the present time (May, 1915) the purification effected, based on the four-hour-oxygen-absorbed figure, with only one and one-half hours' blowing without chemicals and without filters, is from 90 to 94 per cent. These results appear to be practically automatic, seeing that Mr. W. H. Duckworth, the Manager, gets these results day in and day out with unfailing regularity. Porous plates are about to be installed, and it will be instructive to know what results will be obtained. The tank has a capacity of 25,000 gallons, and in October last received three charges a day. Another tank of similar capacity was inoculated in October, and no doubt by this time the process has been further enlarged. The Salford experiments were conducted by Mr. S. E. Melling and Mr. Duckworth.

There are certain conditions which appear to be essential in order to achieve the best results—for example, the air as it is blown through the sewage must be atomized or diffused so as to allow the sewage to dissolve as much atmospheric oxygen as possible. It will be conceived that, the larger the bubbles of air, the quicker they rise to the surface, and also the less surficial contact they have to part with the oxygen, whilst fine bubbles remain longer in the sewage and the oxygen is imparted to the sewage more effectively. Tests were made at Manchester to compare the results of air blown in through a tube and air diffused through a porous plate, with the following results:—

	Plain Tube	Diffuser	Percent increase in dissolved oxygen
At commencement	0.24	0.24	0.00
After 15 minutes	0.42	0.73	74
After 30 minutes	0.49	0.74	46
After 45 minutes	0.56	0.76	36
After 60 minutes	0.57	0.77	35
After 90 minutes	0.63	0.79	25

The temperature of the sewage has a material influence on the efficiency of the treatment, just as it has in the ordinary biological works at present in use. For example, in experiments made the percentages of ammonia oxidized at different temperatures were as follows:—

	After 3 hours' aeration	After 6 hours' aeration	After 9 hours' aeration
At 5° C. (41° F.)	1	2	6
At 15° C. (59° F.)	4	24	46
At 13° C. (55.4° F.)	2	14	22
At 20° C. (68° F.)	1	22	57
At 30° C. (86° F.)	1	10	26

The oxidation process was retarded when the temperature was constantly below 50° Fahr., whilst at 86° Fahr. the clarification was interfered with. It would appear that the sewage temperature should be maintained at about 60 deg. Fahr. This in itself is an important problem in Canada, because the temperature of raw sewage in some places tends to keep below 50 deg. Fahr. during the winter months, while the atmospheric temperature is often below zero Fahr., especially in the West. Consequently, it is apparent that the air must be warmed if the sewage temperature is to be maintained above 50 deg. Fahr.

Activated sludge is virtually the same in the Lawrence aerated slate bed, in well aerated perco-filters, and in the activated sludge process, and in each case performs practically the same functions.

The sludge resulting from the activated sludge process is quite inoffensive, dark brown in color (somewhat similar to that obtained at Lawrence), flocculent in character, low in specific gravity, but easily separated from water. The dried sludge at Manchester, Salford and Urbana had the following manurial constituents:—

	Manchester	Salford	Urbana	Salford ordinary sludge
	%	%	%	%
Nitrogen	4.6	3.75	6.30	1.20
Phosphate	2.6	2.10	3.31	1.10

It will be seen from the above that the fertilizing properties in activated sludge are much greater than in ordinary sewage sludge, and, furthermore, instead of being greasy, slimy and sticky, as in ordinary cases, it is granular, like sand.

Dr. Edward Bartow estimated that the manurial value of activated sludge produced at Urbana, Ill., was worth approximately $29 a ton of dried sludge; so that sewage sludge under these conditions would be an asset to the disposal works, instead of being a heavy liability from a financial viewpoint and an ever-accumulating mass of rubbish from the practical side.

Quantity of Air.—In the Manchester experiments the quantity of air blown in was at the rate of fifteen cubic feet an hour to a square foot of tank area. Dr. Bartow found that twelve cubic feet an hour sufficed.

Dr. Fowler expressed the opinion that the period of aeration, and therefore the quantity of air, depended not only on the strength of the sewage, but also on the degree of purification required.

Dr. Bartow found that after one hour's aeration a sample of supernatant water did not decolorize methylene blue for twelve days—showing that, even if complete nitrification had not been effected, the effluent was stable.

Mr. Wakeford stated that at Wakefield, England, with a very concentrated sewage containing a large quantity of trade refuse the present cost of treating the sewage with lime was $4.25 to a million gallons, whereas, considering the result of the aeration experiments in Wakefield, he could not see why the cost should not be reduced to $2.50.

Creosoted Blocks—A Promising Export Trade

ONE of the lines of lumber products for which there is a very promising future in the export trade, as well as in the domestic trade, is that of wood blocks for pavement purposes. Creosoted wood blocks laid under modern conditions are superior in wearing qualities to macadam, brick, asphalt, granite, or sandstone. As far back as 1901 the Metropolitan Street Railway Company of New York City made an experiment with creosoted wooden blocks for pavement between its tracks. A small area was laid, the wood being flanked at either end with granite, the material formerly used. The wood selected was long leaf yellow pine. There was a heavy truck traffic at the place where the experiment was made. At the part of the road where the trucks run with one wheel just outside the car rail the stresses on the pavement were very great, and the granite showed a rut in six months, requiring renewal almost annually. At the end of four years the wood, although showing a heavy rut, was still sound in position and good for at least one more year. The granite on either side had been renewed three times during the four years. The facts of this experiment are reported in United States Forest Circular No. 141.

Export Trade in Hardwood Flooring

Free Admission Into the United States Assisting Our Industry — History of U. S. Tariff Changes

WHEN, in 1913, the United States reduced the tariff on lumber there were some lumbermen who were doubtful as to whether it would have any appreciable effect upon the volume of Canadian exports. Experience has shown that, in respect of hardwood flooring, the abolition of the duty of $2.37½ for every 1,000 feet has increased our sales in the American market. The history of the placing of hardwood flooring on the free list is interesting, and the position of the wood in that category may perhaps be regarded as unintentional. When the schedules were issued it was found that hardwood flooring was omitted from paragraph 647, providing for the admission of certain classes of lumber free, and also from paragraph 176, which imposed a 15 per cent. duty on certain descriptions of manufactured lumber.

In these circumstances, the United States Deputy Collectors of Customs put hardwood flooring under paragraph 176, the result being that the duty, instead of being lowered, was considerably raised—in some instances more than trebled. The Seaman, Kent Company, Limited, of Meaford, Ont., Fort William, Ont., and Montreal, Que. promptly got into communication with the authorities at New York, Boston and Washington, and Mr. Kent and Mr. J. A. Bernard, the Montreal manager, visited these points and put their case before the authorities. The case they presented was very simple—it was that the Act was intended to reduce the duties, whereas the effect of putting hardwood flooring under paragraph 176 was to increase them enormously. The contention of the Customs authorities was that hardwood flooring, without being mentioned specifically, came within the definition of paragraph 176, objection being taken to the ploughing, and matching, boring, and dressing on the back (being in fact further manufactured than planed, tongued and grooved), these constituting, it was argued, processes of manufacture which rendered hardwood flooring liable to the duty of 15 per cent. The answer to this was that if the flooring was hollow-backed and bored it was manufactured for no further purpose than planed, tongued, and grooved lumber. The boring and the hollow-backing was done to satisfy a caprice of the public, and was not a real necessity. The boring was practically never used, and the hollow-back answered only the purpose of reducing the weight of the flooring for freight and of enabling the face to be distinguished from the back.

Considerable correspondence took place, and as a result a decision was come to. It was contained in a letter from the Treasury Department, Washington, addressed to the Collector of Customs, Ogdensburg, N.Y., as follows:—

Outline of the Tariff Situation

"The Department duly received your letters of the 7th and 9th ultimo relative to the proper classification of the lumber described in the list enclosed in your last mentioned communication, consisting of pieces of novelty siding, stair rails, base mouldings, sash rail, sash mortice, etc., samples of which lumber you forwarded under separate cover. As paragraph 647 provides for the free entry of sawed boards, plank, deals, and other lumber not further manufactured than sawed, planed, tongued and grooved, you inquire whether any of the samples submitted represent lumber further advanced than planed, tongued and grooved. The Board, in Abs. 13267 (T. D. 27685), held that certain so-called novelty siding which has been so shaped that one board overlapped the other was not subject to the additional duty provided in paragraph 195 of the Tariff Act of 1897 for tonguing and grooving. In a later decision, G. A. 5441 (T. D. 24719), the Board had before it for decision the proper classification of pieces of board ⅛ inch in thickness, and varying in width from 4 to 10 inches, and in length from 26 to 39 inches, the boards having been printed to represent cedar.

"The boards were assessed with duty as manufactures of wood under paragraph 208 of the Tariff Act of 1897. The Board held that the operation of printing did not constitute a manufacture of wood, for the reason that the boards had not been given a new name, character or use, but still remained wood, and as there was not provision for the importers that the wood was dutiable as sawed lumber under paragraph 195 of the said Act.

"The United States Circuit Court of Appeals for the second Circuit in T. D. 27385 affirmed the decision of the Board of U. S. General Appraisers that ordinary sawed lumber which had been subject to the fireproofing process which greatly increased its value was not, by reason of the process, removed from the provision in paragraph 195 of the Tariff Act of 1897 for sawed lumber.

"It will be noted, from the decision cited, that lumber may be advanced in value and conditions beyond that of lumber planed, sawed, tongued and grooved, and yet not be a manufacture of wood.

"While it is difficult to establish a well defined line of demarcation between lumber that is dutiable as manufactures of wood under paragraph 176 of the Tariff Act and lumber which falls within the provisions of the said Act, the Department is of the opinion, in view of the decisions cited, and giving due consideration to the purpose of the present Tariff Act, which is to reduce duties, that flooring, although in addition to being planed and tongued and grooved, it is ploughed on the under side to ensure a perfect fit to the board as flooring, is not excluded from the classification under paragraph 647. The Department is also of the opinion that the ordinary novelty siding, ordinary window parting strips, outside baseboards, ordinary siding, and other articles which are not moulded or beaded, are entitled to admission free of duty under paragraph 647.

"Articles such as sash rail, stair rail, crown moulding, signboard moulding, and similar articles, when beaded or moulded, are, in the opinion of the Department, properly dutiable as manufactures of wood at the rate of 15 per centum ad valorem under paragraph 176 of the Tariff Act."

Prior to the tariff revision of 1913 Canadian manufacturers had been sending a fair quantity of hardwood flooring into the eastern States, being able to compete, in times of good trade, owing to the favorable railway rates due to the geographical position of our mills. The great bulk of the American hardwood flooring comes from Michigan, and the long railway haul to the eastern States was a handicap when competing with Canadian mills. The imposition of the 15 per cent. duty would have more than counterbalanced any advantage we held owing to close proximity to markets, and would, in fact, have killed our export business. The placing on the free list, on the other hand, is a decided advantage, and has tended to increase the trade.

Addition to Post Office Building, Victoria

THE end of May saw the completion of the extensive additions to the Post Office building at Victoria, work on which was commenced in April of last year by The McAlpine Robertson Construction Company, of Vancouver, the successful tenderers. The additions comprise three storeys and a basement, covering an area 108 x 100 ft. The total cost of the work was about $150,000.

New wing of the Post Office Building, Victoria, B.C.

The construction is steel columns and beams, with wood joists. The external walls to the three street fronts—Humboldt, Courtney and Wharf—are of granite and cut Gabriola stone. The interior finish is of B. C. fir throughout, except that maple flooring is laid on the ground floor. Metal lath and hardwall plaster were used throughout. The stairs are of ornamental iron, with B. C. marble treads and landings. The main vestibule is finished in marble, the walls being lined to a height of nine feet. Two elevators are provided—one freight and one passenger.

Daily Cost-Data Sheets on Concrete Road Construction

DURING 1914 the Association of American Portland Cement Manufacturers gathered statistics covering the actual costs of a number of concrete roads and pavements. The costs obtained, according to the Engineering Record, were for labor, teaming, mechanical equipment, preparation of subgrade, and the mixing, placing, leveling and curing the concrete. In order to make olgical comparisons of costs for different sections of the country all "cost factors" that do not enter into the cost of the road "crust," such as earth and rock excavation, overhaul, stone sub-base, etc., were eliminated.

For ease of tabulation the cost data were divided into five major items: Labor, teaming, mechanical equipment, actual quantities used in constructing the concrete pavement, and various miscellaneous items.

The labor, exclusive of that used on mechanical equipment and teaming, is classified by location so that a comparison could be easily made between separate jobs regarding the efficient handling of men. The cost of teaming is sub-divided so that comparisons may be very readily made and under "Mechanical Equipment" the cost of plant, the interest and depreciation and the cost of labor and supplies have been given.

Economy dictates that the amounts of materials used should closely check with those theoretically required. The tabulation is arranged so that the cost of materials may be quickly lumped.

The miscellaneous items are naturally of small moment, but they have been added so that the figures may be conservative.

Approximately 1,500,000 sq. yds. of pavement were covered by this method of estimating distributed as indicated in the accompanying table.

In general contract work the methods of cost accounting are more or less haphazard and it would doubtless pay the road contractor to evolve a simple cost data scheme along the lines suggested.

Average Cost of Concrete Roads (1914)

State	Labor	Teaming	Mech Equip.	Materials	Misc.	Total Number	Sq. Yds
Connecticut.	$0.181	$0.142	$0.046	$0.752	$0.010	$1.088	200,066
Florida	0.108	0.028	0.003	0.838	0.014	0.991	13,000
Indiana	0.134	0.130	0.044	0.777	0.022	1.017	89,794
Illinois	0.136	0.101	0.033	0.528	0.016	0.814	17,970
Iowa	0.213	0.084	0.028	0.789	0.036	1.116	90,364
Kansas	0.396	.....	0.026	0.819	0.007	1.248	1,503
Kentucky	0.146	0.214	0.020	0.477	0.018	0.875	4,144
Maryland	0.111	0.128	0.065	0.716	0.057	1.077	36,211
Massachusetts	0.195	0.101	0.039	0.609	.....	0.947	26,200
Michigan	0.222	0.032	0.021	0.655	0.050	1.028	92,217
Mississippi	0.261	0.085	0.150	0.642	0.094	1.232	12,031
Missouri	0.209	0.133	0.027	0.656	0.059	1.045	22,376
New Hampshire	0.126	0.097	0.032	0.907	.....	1.162	6,066
New Jersey	0.179	0.089	0.016	0.797	.....	1.091	8,355
New York	0.156	0.085	0.055	0.666	0.050	1.027	730,982
Ohio	0.181	0.091	0.067	0.642	0.009	0.946	58,968
Pennsylvania	0.279	0.091	0.031	0.742	.....	1.269	10,072
Texas	0.316	0.117	0.007	0.668	0.016	1.123	6,642
West Virginia	0.098	.....	0.060	0.912	.....	1.070	10,045
Wisconsin	0.188	0.110	0.045	0.682	0.023	1.033	61,879
Grand Average	0.183	0.105	0.040	0.719	0.046	1.058	*1,498,883

*Exclusive of profits and overhead charges.

Labor	No. Hrs.	Wages per Hour	Total Cost	Total Amount Handled	Cost per Cu. Yd.	Sq. Yd. Cost per Pavement
On Sand at Pit or Washer	..	.....				
On Sand at Work	3 1/3	.....	5.00	49 cu. yd.	$0.102	$0.0069
On Stone at Cars or Quarry	6 2/3	.....	10.00	99 cu. yd.	0.102	0.0138
On Stone at Work	..	.....	.....	....	.....	......
Wheeling Sand at Job	40	$0.175	7.00	49 cu. yd.	.....	0.0097
Wheeling Stone at Job	80	0.175	14.00	99 cu. yd.	.....	0.0194
On Mixer, Loader	30	0.175	5.25			0.0041
Engineman	10	0.30	3.00			0.0072
Fireman	10	0.20	2.00			0.0028
Chute or Bucket	..	.....	....			0.
Sub Grade before Mixer	10	0.175	1.75			0.0024
Sub Grade behind Mixer	..	.....	....			0.
Leveling Concrete	20	0.175	3.50			0.0048
Templet Men	20	0.175	3.50	124 cu. yd.		0.0048
Finishing Pavement	20	0.175	3.50	concrete	....	0.0048
Forms, Joints and Reinforcement Men.	20	0.175	3.50			0.0048
Wetting Pavement	5	0.175	0.875			0.0012
Covering New Pavement	20	0.175	3.50			0.0048
Superintendent	10	0.750	7.50			0.0103
Watchmen	5	0.175	0.875			0.0012
Timekeeper	10	0.300	3.00			0.0041
Foremen	10	0.400	4.00			0.0055
Waterboy	10	0.150	1.50	....	...	0.0021
Engineman at Sand Washer	..	.....	.....	....	.....	......
Total Labor						$0.1147

Teaming	No. Trips	Cost per day	Total Cost	Av. Haul or Pump	Amount Hauled or Pumped	Cost per Cu. Yd. Mile or 1000 Gal. Mile	Cost per Cu. Yd. at Job	Amt. per Sq. Yd. Pavement	Cost per Sq. Yd. Pavement
Sand	16	$13.95	....	1,300 ft.	49 cu. yd.	....	....	....	0.0192
Stone, 2 trucks	33	28.78	....	1,300 ft.	99 cu. yd.	....	....	....	0.0397
Cement, 1 team	21	18.27	....	1,500 ft.	957 sacks	....	....	....	0.0252
Water	..	6.00	....	....	......	....	....	....	0.0083
Total teaming									$0.0924

Mechanical Equipment	Cost of Plant	Int and Deprec. of Plant 0.00154 x Cost	Cost of Labor	Cost of Supplies	Cost of Sq. Yd. Pavement
Steam Roller	$2,000	$3.08	$3.00	$3.00	$0.0125
Wheel Scraper	......	....	....	....	......
Scarifier	......	....	....	....	......
Pumps	600	0.93	3.00	3.00	0.0097
Mixer	1,850	2.85	5.00	....	......
Forms	.....	....	....	....	......
Barrows, Boxes, etc.	.....	....	....	....	......
Tractor	.....	....	....	....	......
2 Motor Trucks	7,100	11.13	6.00	6.00	0.0319
Sand or Gravel Washing Plant	.....	....	....	....	......
Stone Crushing Plant	.....	....	....	....	......
1 Hoist	7,000	10.78	7.00	8.00	0.0356
Total mechanical equipment					$0.0897

Quantities and cost of materials theoretically required and actually used on $\left\{ \begin{array}{l} \text{410 lin ft.} \\ \text{725 sq. yd.} \end{array} \right\}$ of above road. Barrel of cement equals 3.8 cu. ft.

	Quantity	Per Unit Cost	Average Haul	Total Cost at Job Excl. of Haul	Cost per Sq. Yd. of Pavement
Theoretical:					
Cement	237 bbls.	$1.15 F.O.B. Cars	at job		
Sand	49 cu. yd.	1.63 F.O.B. Cars 0.77 cu. yd. Pit	at job		
Stone or gravel	99 cu. yd.	1.85 F.O.B. Cars 0.70 cu. yd. Pit	at job		
Actual:					
Cement	239.2 bbls.		1500	$275.08	$0.379
Sand	50 cu. yd.		1300	81.50	0.112
Stone or gravel	101 cu. yd.		1300	186.85	0.258
Steel or wooden joints	224 lin. ft.			10.08	0.014
				Total materials	$0.763
				Grand total	$1.0598

Notes:

The above report is taken as an average for the last seven working days: 410 linear feet per day, or 725 square yards of pavement.

Amount of water used cannot be determined.

Hauling of materials by two motor trucks and one wagon.

Cost of hoist is estimated.

Standard Form for Tabulation of Cost Data

State of ... ... Contract No. ... ... to ... ... Co.
Work Began or Completed ... ... Began or Finished Concrete ... ... Working Days
Cross Section 4¾ in.-6¾ in.-4¾ in.-16 ft. wide. Contractor ... ...
Equipment 10 Ton Roller (........) ... ... Traction Engines ... ... Wheel Scrapers
... ... Scarifier 1-2 H. P. Pump ... ... Sand Washing Plant Capacity ... ...
1 Hoist 2 Stone Trucks
Daily Report —Sept.7, 1914. ... ... Road Ass't

The Sooke Lake Water Supply for the City of Victoria, B. C.

Details of Dams at Sooke Lake and Humpback Reservoir—An 18-Mile Pipeline Brings Water to the City

By C. H. Rust*

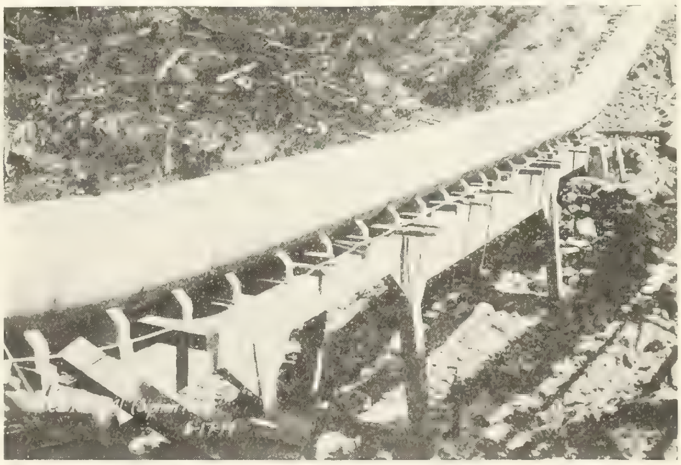
THE first water-works system for Victoria was installed in 1868 by a private company, who pumped water from wells, which was delivered through wooden pipes, at a charge of three-quarters of a cent a gallon.

In 1872 the growth of the town necessitated a more adequate supply, and the city investigated the possibility of obtaining a supply from Elk Lake, which is situated in a north-easterly direction about five miles from the city. The official report made estimated that a supply of two and a half million gallons daily could be procured, and work towards obtaining water from this source was proceeded with. Until recently the water was procured from this lake by two pipe lines—one a gravity supply to the lower part of the city, the other carrying the water to the North Dairy Pumping Station, where it was pumped to Smith's Hill Reservoir. Three slow sand filter beds were established at Elk Lake. In recent years these have been worked beyond their capacity.

Owing to the rapid growth of the city, the level of the lake was lowered considerably, and the quality of the water impaired. In 1913 arrangements were made with the Esquimalt Water Works Company to procure a supply from them pending the completion of the Sooke Lake scheme, the city agreeing to pay that company six cents for every thousand gallons. The cost of procuring water from Elk Lake was two cents for every thousand gallons.

Dam at Humpback Reservoir.

In July, 1911, owing to the inadequate capacity of Elk Lake, the city decided to look for another source of supply, and various projects were considered. It was finally decided to utilize Sooke Lake, which lies about eighteen miles north-west of Victoria. The lake was subjected to a very careful investigation, including the study of rainfall, runoff, contour surveys, etc., and before the end of 1911 tenders were called for. The work of finding a proper grade for the flow line was one of great difficulty, owing to the dense forest and rocky bluffs.



Trestle carrying concrete flowline.

Sooke Lake is about four miles in length and half a mile across at its widest part. The area of the lake at low water, which is 555 ft. above sea level, is 978 acres. It was decided to construct a dam at the foot of the lake and raise the level of the water 12 ft. This gives a total area of 1,180 acres, the total watershed area being 31.33 square miles.

In the scheme for the ultimate development it is also proposed to utilize the Leech River watershed by building a dam in the stream and constructing a five-mile conduit to convey the water to Sooke Lake. When this is done a dam rising to a height of 45 ft. above the present low-water level of the lake is projected, and it is estimated that a daily flow of 100 second feet will be available, whilst the reservoir storage above low-water level will be 17,358,000,000 Imperial gallons. The initial project now under way by the use of a concrete dam at the outlet of the lake gives a reservoir capacity above low-water of 5,555,000,000 Imperial gallons.

The contract provided that the margin of Sooke Lake should be cleared to 15 ft. above low-water. This affected 300 acres of thick forest, which had to be cut down and burned. About two miles of waggon road along the east side of the lake had to be constructed, as the raising of the lake covered the existing road.

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*City Engineer and Water Commissioner, Victoria, B.C.

At the dam the intake channel is excavated 4 ft. below low-water, where an intake tower is constructed, controlled by seven sluice-gates. The gate openings are protected by screen cages. From the intake tower two lines of 40-inch riveted steel pipe are laid to convey the water to the screen house. Only one of these is in service at present. In the screen house is installed a set of twelve screens with a mesh of forty openings to the inch. Below these are the measuring weir and cascade steps. The screen house is of concrete, with a concrete roof, and a sink is provided for washing the screens.

Concrete pipeline near Humpback.

The dam is a composite structure, the west end being an earth embankment with a concrete core wall bonded into the natural rock. From the screen house to the east abutment an ogee weir section 200 ft. long is built, which is generally about 15 ft. above the foundation of natural rock.

Three alternative plans were considered in connection with the flow line, and the bids resulted in a decision to lay a reinforced concrete pipe line, the grade being one in one thousand.

The plans called for a pipe 40 inches in diameter with 3-inch thickness of walls, but it was finally decided by arrangement with the contractors, without any additional cost, to lay one of 42 inches. The concrete pipes are made in 4-ft. lengths. Fifty-four per cent. of this line is on curves. This will give a daily flow of approximately twenty million Imperial gallons.

A right-of-way 100 ft. wide was secured for the pipe lines, all trees were cut down, and also any tall trees outside the strip which in falling might damage the pipe. The pipe is not covered except in a deep cut at Humpback, where slides might occur.

At each 2,000-ft. point on the conduit line there is an open standpipe, and all inverted siphons, of which there are six, have waste outlets at the bottom controlled by six-inch gate valves. The pipe for siphons was made of 4-inch walls, with heavy steel reinforcement, varying in quantity according to the head. The deepest siphon is 600 ft. in length, and has a maximum head of 90 ft.

One of the difficulties in connection with this project was the securing of a reserve reservoir at the proper elevation and in fairly close proximity to the city. A suitable site was finally located at Goldstream at the Humpback Road, about 10¾ miles from Fountain Square in Victoria. This reservoir has a storage capacity of 136 million gallons, and covers an area of 33½ acres, from which it was necessary first to clear a very thick forest. The earth on a portion of the reservoir site is of black soil of a peaty nature, and this was covered with a 6-inch layer of clean sand and gravel.

The dam is about 560 ft. in length and 60 ft. in height, and contains about 9,000 cubic yards of masonry.

The gate house, with control valves and screens, is provided at the dam, and two cast-iron outlet pipes 34 inches in diameter are installed for the delivery to the pressure main. The water flows into the reservoir from the flow line over a series of steps, and there is also constructed a by-pass 24 inches in diameter whereby the water can be taken direct from the flowline to the pressure main without entering the reservoir. In addition to the by-pass, there is a pipe with a submerged outlet controlled by a butterfly valve.

From Humpback reservoir the water is delivered to the city through a 36-inch riveted steel pipe. It was not considered advisable to deliver the pipe direct to the city service system, as the pressure would be too great; so the water is allowed to overflow into Smith's Hill reservoir, which acts as a standpipe. This reservoir is situated at an elevation of 167 ft. below the water level of Humpback reservoir, or 213 ft. above sea level.

The pressure pipeline consists of two thicknesses of plate, 20,500 ft. of pipe using plates 5-16-in. in thickness, and 36,500 ft. of pipe using ⅜-in. plate. The pipe was made in sections 22 ft. long, and each pipe was dipped in an approved coating mixture. There are four concrete gate houses along the line. Inlet and outlet valves are also attached at frequent intervals. A Venturi meter with a recording apparatus is instal-

Pressure pipe at Station 53.

led in the concrete house below the Humpback dam, by which an accurate record is kept of the water passing through the pressure main.

The contract for this work was awarded originally to the Westholme Lumber Company. In April, 1913, after completing about 38 per cent. of the work, the Westholme Lumber Company abandoned the contract, and the work, with the exception of contracts being let for the construction of the concrete flow line and the pressure pipe lines, was carried out by a force account. This involved the construction of 27 miles of railway track on the concrete flow line with a gauge of 2 ft., the erection of a number of wooden trestles over the different canyons, and also reinforced concrete trestles and a steel bridge crossing Sooke River for carrying the pipe, and the construction of the dam at Sooke Lake and Humpback, also the completion of the clearing at Sooke Lake which had not been finished at the time the contractors abandoned the work.

A number of camps were erected at different points, and a large force of men were employed. The wages paid were $2.75 for eight hours. The men were charged one dollar a day for their board, and medical service was furnished by the city Medical Health Officer free of charge.

During the construction of this work, some parts of which were of a very hazardous nature, no fatal accidents occurred.

The contracts for the flow line and pressure pipe lines were awarded to the Pacific Lock Joint Pipe Company and the Burrard Engineering Company, respectively, and both these firms completed their work in a most satisfactory manner.

The following are a few data in connection with this work:—

Area of Sooke Lake at 665 ft. elev. city datum .	978 acres
After 12-ft. rise, area	1,180 acres
Land clearing around the lake	300 acres
Length of concrete flowline 42 inches in diameter	144,040 ft.

The first pipe was made 20th April; laying commenced 16th May, 1914; and the flowline was finished on 8th May, 1915.

Length of pressure pipeline, 36 inches in diameter, 56,677 ft.; manufacture of pipe was started in July, 1914; and laying was finished January, 1915.

Total quantities of earth excavated	180,342 cu. yds.
Total quantities of rock excavated	150,517 cu. yds.
Total cost of work to date (exclusive of land) ...	$1,720,000
Cost of land on the shores of Sooke Lake, the right-of-way for the concrete flowline and pressure pipelines, and land required for the construction of the Humpback Reservoir	$370,000
Approximate cost of land for the Sooke Lake watershed	$200,000

The population of the city is 50,000, and the daily consumption of water in winter averages 60 gallons per capita head; in summer, 80 gallons.

Mr. Wynn Meredith, representing Sanderson & Porter, was Consulting and Designing Engineer. Their Resident Engineer for the greater portion of the time was Mr. Boyd Ehle. Mr. J. L. Raymur was Water Commissioner until November, 1912, when Mr. C. H. Rust was appointed.

Economy in reinforced-concrete structures as compared with steel construction is computed at from 10 to 20 per cent. for building columns and floors by T. A. Watson in a paper presented before the Concrete Institute, London. He asserts further that reinforced concrete is nearly always the most suitable material for bridges up to at least 300 ft. in span. There are exceptions, but the mere question of cost of maintenance of a steel bridge is enough to condemn it; and this, coupled with the fact that the life of many wrought-iron bridges has been only about 65 years and that steel cannot be expected to last any longer, is a strong argument in favor of reinforced concrete. Apart, however, from the question of maintenance, the saving effected in cost of reinforced concrete over steel bridges is sufficient to justify its adoption, as much as 40 per cent. having been obtained in a bridge of 42-ft. span, 26 ft. wide between parapets.

A Simple Method of Applying Liquid Chlorine Under Pressure[*]

THERE are a number of water plants in the United States using pressure filters in which it would be desirable to use chlorine or hypochlorite of calcium as an aid to rendering the filtered water safe.

As there has been no very satisfactory method heretofore for thus treating the filtered water under pressure with liquid chlorine, engineers have resorted to the plan of applying the chlorine solution to the raw water, and, by using a considerable amount more than would be necessary otherwise, the bacterial purification of the filtered water can be maintained at the desired degree. However, this phase of water purification has been the principal reason why many engineers prefer open gravity filters to pressure filters, because with the former the chlorine solution can be discharged directly into the filtered effluent where it does the most effective work.

The following plan would seem to be satisfactory for accomplishing this result with pressure filters.

Assuming that we are using liquid chlorine instead of hypo-chlorite of calcium, the needle valve connecting the top of the liquid chlorine tank would be opened sufficiently to discharge the desired amount of chlorine gas to a unit of time. This chlorine gas would be conducted up through five or six feet of, say, 8-in. vertical pipe (concrete or terra-cotta), filled with broken pumice stone. At the top of the tank is sprayed the purified water, which, passing down through the broken stone, takes the chlorine gas into solution and discharges into a small tank of, say, twenty gallons capacity. This tank is maintained at a constant level by means of a float valve which controls the sprayed supply of purified water. The solution from the small tank is then pumped into the discharge main beyond the pressure filters by means of a reciprocating pump operated by either a water motor, electric motor, or a link connection with the main pumping engine, where this handles the entire supply, and thus the solution will be proportional to the rate of pumpage.

In most cases for small plants, where the amount of chlorine is, say, from one to four pounds to every million gallons, it is not important that the supply of chlorine be in direct ratio to the pumpage. It is only necessary that there be sufficient chlorine to sterilize properly the supply, and therefore the needle valve is set so that a given amount of chlorine can be discharged in the unit of time, say one day, and this can be readily effected by a few trials. The strength of the solution recommended should be so weak—say, 1 part in 10,000 or more—that the chlorine is all taken into solution, and hence will not materially injure the parts of the small pump.

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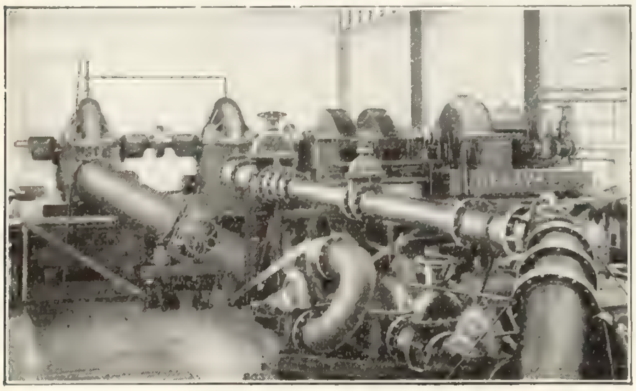
[*] Described by J. W. Ledoux, Chief Engineer, American Pipe and Construction Company, Philadelphia, Pa., in Engineering and Contracting.

Steam-Turbine-Driven Centrifugal Pumps in the Toronto Water-Works

THE two pumping stations of the Toronto Waterworks epitomize, it might be said, the whole development of water-works pumping machinery in America, although at the present time some of the oldest units are being discarded in favor of more modern and economical apparatus. The John Street Pumping Station, which is the main station, supplies all sections south of College and Gerrard Streets, and delivers water to two large mains, one going to the reservoir in the northern part of the city at a pressure of 20 lbs., and the other to the centrifugal pumps in the High Level Pumping Station, about three miles north. It contains two 10,000,000-gallon horizontal compound Worthington duplex pumps, which, though installed about twenty-five years ago, are still used at certain periods. There are also two 15,000,000-gallon vertical triple-expansion high duty reciprocating pumping engines built after Allis-Chalmers designs by the John Inglis Company, of Toronto, installed eight and six years ago respectively, and four 13,500,000-gallon single-stage centrifugal pumps, operating against a head of 110 lbs. and driven at 750 r.p.m. by Canadian Westinghouse 1,500 h.p. motors. The latter pumps were installed about two years ago, and are operated with Niagara Falls power. There are also two 5,000,000-gallon centrifugal pumps directly connected to steam turbines, and two other pumps of the same capacity and make, directly connected to Westinghouse motors, all intended for high pressure fire service.

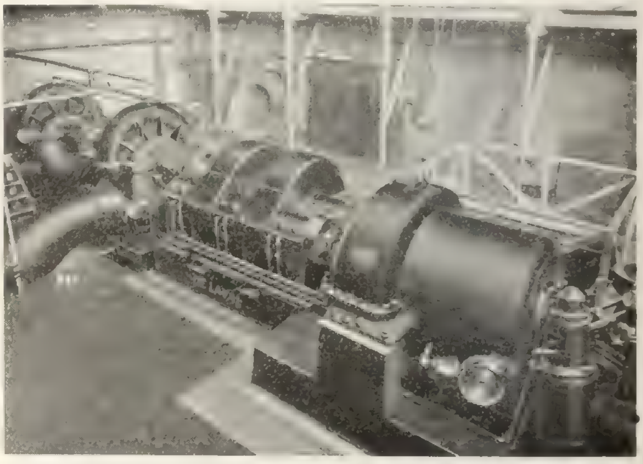


DeLaval centrifugal pumps in the John Street Station of the Toronto Water-works System; capacity, 15,000,000 gals. a day.

With a view to increasing the capacity and economy of this station, specifications were issued in October, 1912, for machines of three different types: (a) a self-contained vertical triple-expansion fly-wheel plunger pumping engine with jacketed steam cylinders; (b) a centrifugal pump driven by a triple-expansion condensing engine, running at a speed of not over 350 r.p.m.; and (c) a centrifugal pump driven by steam turbine, the pump speed not to exceed 750 revolutions; the capacity in each case to be not less than 15,000,000 Imperial gallons of water for 24 hours against a pressure difference of 105 lbs. to a square inch between the suction and discharge mains. It was provided in the specification that a duty in excess of 100,000,000 foot lbs. to a thousand lbs. of saturated steam should be guaranteed, with a bonus of $1,500 for each million foot lbs. in excess of the guarantee, the total bonus not to exceed $10,000, and a penalty of $2,000 to be imposed for each million foot lbs. less than the guarantee, a deficiency of more than 5,000,000 foot lbs. below the guaranteed duty to render the pump subject to rejection. It was provided further that the steam pressure should be 150 lbs. gauge at the boiler, and that the steam should not contain more than 1½ per cent. of entrained water; also that the steam consumed by the auxiliary pumps, jackets, reheaters, air pumps, air compressors, boiler feed pumps, all of which were to be supplied by the contractor, was to be included in figuring the duty.

The decision as to the type and make of pump was made on the basis of net economy, or lowest cost to the gallon of water handled—that is, interest and depreciation charges on the cost of machinery, foundations and buildings and expenses for labor and supplies were taken into consideration as well as steam consumption. By requiring the contractor to supply the condensing equipment, and by charging him with the head consumed in friction in the condenser and with the steam required for operating the condenser pumps, full opportunity was given to the turbine manufacturer to take advantage of the better use which the steam turbine can make of high vacuums as compared with the reciprocating engine.

The contract was awarded to the Turbine Equipment Company, Limited, of Toronto, representing the DeLaval Steam Turbine Company, of Trenton, New Jersey, for a 1,400 h.p. steam turbine designed for a speed of 3,600 r.p.m., driving, by means of double helical speed-reducing gears, two 24-in. centrifugal pumps to operate at 600 r.p.m. The turbine is of the impulse pressure-stage type, and contains 14 stages. The gear is of the three-pinion bearing type, and is connected to the turbine and to the pump shaft by flexible couplings. Both turbine and gear are lubricated by a gravity system, an oil pump attached to the governor shaft forcing the oil through a cooler to an overhead tank, from which it runs to the bearings. The larger gear bearings and the pump bearings are ring oiled.

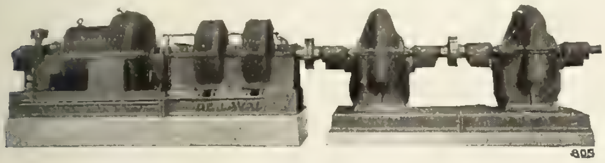


One of the two 24,000,000-gal. DeLaval geared turbine-driven centrifugal pumping units in the John Street Station.

The two pumps are of the single-stage double-suction type, and are operated in series—that is, the discharge from the first pump is carried to the suction of the second pump. The pumps are primed by a single steam ejector connected to the top of each pump casing.

The condenser, built by the C. H. Wheeler Manufacturing Company, is of the water-works type, in which the steam is inside the tubes and the water outside, and contains 1,500 sq. ft., made up of one-inch brass tubes each 7 ft. 2 ins. long. All of the water handled by the main pump passes through the condenser. The air pump is of the wet vacuum type, the steam end being of the ordinary slide-valve type, controlled by throttling governor. The steam for driving the air pump is taken from the main supply pipe between the separator and the steam turbine. As no oil is allowed to reach the inside of the turbine, the condensed steam is passed into the hot well and delivered to the boilers by a triplex, single-acting boiler feed pump driven by chains from the main pumping unit.

The acceptance test on this pump was run on November 30 and December 1, 1914, under the supervision of Prof. Robert W. Angus, of the University of Toronto, assisted by senior students from that institution. The contractor was represented by Mr. C. R. Waller, Chief Engineer of the DeLaval Steam Turbine Company, and the purchaser by Mr. McRae, Chief Engineer of the pumping station. Throughout the test, which was of twenty-four hours' duration, suction and discharge pressures, Venturi meter and condensate weight readings were taken every seven and a half minutes, while the steam main and nozzle pressures, vacuum, speed, and calorimeter readings were taken every fifteen minutes. All gauges were calibrated both before and after the trial and the scales examined and certified by a Government inspector. The barometric pressure during the test was obtained from the records of the Meteorological Office. The principal final results were as follows:



Rear view of 15,000,000-gal. turbine-driven pump.

Steam pressure in main, 148 lbs. per sq. in.

Steam pressure at turbine nozzles, 137.4 lbs. per sq. in.

Absolute condenser pressure, 1.06 in. of mercury.

Pressure difference on pump, 114.1 lbs. per sq. in.

Moisture in steam, 1.05 per cent.

Water delivered, Imperial gallons per 24 hours, 18,373,000.

Water horse-power, 1,016.4.

Duty developed per 1,000 lbs. of steam used, 130,499,000.

Duty guaranteed, 118,500,000.

Steam per water horse-power per hour-lbs., 15.18.

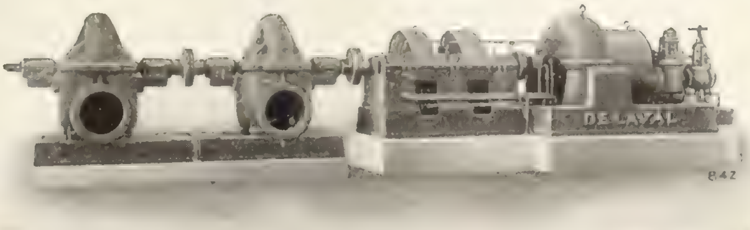
Since placing the first contract, two more units, each capable of delivering 24,000,000 Imperial gallons a day against 260 ft. head, have been ordered for the same station, from the Turbine Equipment Company, Limited; and two DeLaval pumps, one of 20,000,000 gallons capacity against 106 ft. head and one of 7,500,000 gallons capacity against 266 ft. head, have been ordered for the High Level Pumping Station.

The High Level Pumping Station is situated in the northern part of the city, about three miles in a straight line from the main pumping station, and supplies the district north of College Street to the Canadian Pacific Railroad tracks, and north of Gerrard Street in the east of the city. This pumping station, like the main station, exhibits more or less the history of pumping engines, as it contains a Holly vertical triple-expansion pumping engine, having a capacity of 6,000,000 gallons, and a similar pump built by the John Inglis Company, of Toronto. There are also two Blake-Knowles horizontal cross-compound pumps having a capacity of about 4,000,000 gallons. All of these pumps were installed about eight or ten years ago, and two years ago eight electrically-driven centrifugal pumps were installed. An extension is being made to this station for housing the two turbine-driven centrifugal pumps, and also two centrifugal pumps directly connected to Bellis-Morcom steam engines.

The DeLaval turbine-driven centrifugal pumps installed or under contract for the city of Toronto alone aggregate 90,500,000 gallons a day capacity, and 4,390 water horse-power. Although the first large DeLaval steam-turbine-driven centrifugal pump for municipal water-works service was installed by the DeLaval Steam Turbine Company only three years ago in the Ross Pumping Station, Pittsburgh, the total capacity of municipal water-works pumps built or contracted for by this concern now exceeds 600,000,000 gallons a day.

A "breathing pipe" was described at the recent American Waterworks Association Convention by W. F. Wilcox, of Ensley, Ala. Fluctuations in pumping pressure caused a regular heaving of a 50-in. steel pipe line, amounting to 5-32 in., although the movement to those who watched the "respiration" of the pipe appeared much greater. The alternate flattening and expansion of the line caused a crack in the ground above for a length of two miles. An air chamber to take up the surge was installed, and this remedied the trouble.

Erratum.—In our issue of May 26 we published, on page 567, an article descriptive of the new Immigration Building at Vancouver, B. C. We are indebted to Mr. Cole, engineer for Snider Brothers & Brethour, Limited, contractors, for the preparation of this article, and we regret the inadvertent omission of his name.



DeLaval Centrifugal Pumps driven by geared multi-stage turbine, capacity, 15,000,000 gals. a day.

Study of a Water Supply by Pumping for Concrete Road Construction

FREQUENTLY road builders are confronted with the difficulty of obtaining a suitable water supply in connection with concrete construction. In highway work the contractor cannot always arrange for an unfailing supply of water such as his brother contractor in the city may obtain, simply by entering into a contract with the municipality to pay a stated sum of money for such quantities of water as he may need, at the same time feeling sure that the supply required will always be available when needed, says a writer in Engineering and Contracting. In country highway work the contractor must, in nearly all cases, depend upon streams, ponds, lakes or wells for a water supply, and not infrequently must pump water several miles to the point where concrete is being mixed and placed. This has been the experience in concrete pavement construction on that portion of the old National Pike between Zanesville and Hebron, Ohio. Toward the end of the summer many of the streams from which water had been obtained ran very low or nearly dry, and water had to be pumped a distance of 2½ miles, in some cases over grades as great as 10 per cent. for a distance of 1,000 ft. Such problems as this require that careful layout of pipe lines and pumping plant facilities be planned and installed so that the cost of obtaining water may be kept at a minimum.

For the purpose of illustrating possible contingencies to be provided for in work of this kind, the accompanying sketch of pipe line requirements for water supply between the towns X and Y, shown by Fig. 1, has been prepared. Eight and one-half miles of 16-ft. concrete pavement, containing approximately 80,000 sq. yds., and lying between the towns mentioned, is presumed to be the piece of work that must be served by the pipe and pumping system to be used. Common labor is estimated at 22½ cts. an hour; pipefitter, 30 cts. an hour; pumping engineer, $3 a day. In the progress of construction all pipe will be hauled a distance of 8½ miles, as it will be taken off the cars at town X, and after completion of the work shipped from town Y.

Table 1.—Showing Total Head Against Which Water Must be Pumped

Line	Length of pipe, ft.	Friction head, ft.	Static head, ft.	Total head, ft.
A	12,560	189	100	289
B	12,560	189	150	339
C	9,920	149	50	199
D	13,840	208	120	328

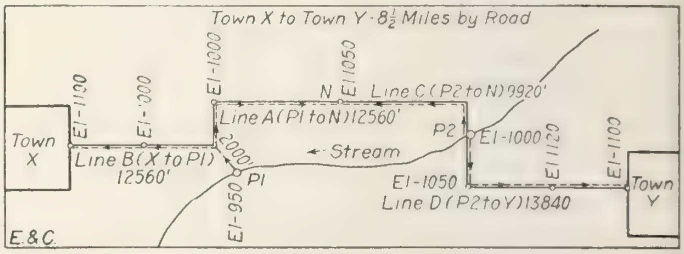
Presuming that concrete will be laid at the rate of about 500 sq. yds. a day, the job will require 213 calendar days for completion. This is based on the experience that not more than 75 per cent. of calendar days can be counted as working days, owing to holidays, Sundays, and interruptions caused by unfavorable weather. On the accompanying sketch, points P—1 and P—2 indicate consecutive positions of pump location. Table 1 shows the heads against which the water must be pumped.

From Table 1, one pump working against a head of 346 ft. or 150 lbs. is shown to be sufficient to deliver 15,000 gals. in a 10-hour day. Fifteen thousand feet of 2-in. pipe will be sufficient to supply water for the entire job. Taking up and relaying this pipe as the work progresses will involve the laying of 47,000 ft. of pipe. A conservative estimate of the time required to move the pump, set it up, and place it in running order, and to take up the pipe line A and place it in position to pipe line C, will be two days.

Two-inch Butt Weld pipe weighing 3.6 lbs. a lineal foot will cost, new, about 10 cts. a foot net, f.o.b. at place of purchase; 2-in. pipe with connections can be rented for 3 cts. a foot for the construction season, the contractor paying the freight both ways. Two-inch gate valves cost $3.00, 1-in. globe valves cost 75 cts., and T's from 2 to 1 in. cost 20 cts. each. Only gate valves should be used in the main 2-in. line.

An efficient pump would be a 3½ x 4-in. Deming, single-acting triplex plunger pump, outside guided and outside packed, delivering 25 gals. a minute when operating at 50 revolutions a minute, when fitted with 16 x 4-in. tight and loose pulleys. The approximate shipping weight for this pump is 1,100 lbs., and the cost is $125. To operate this pump against the maximum head equivalent to a pressure of 150 lbs. will require not less than a 5 h.p. gasoline engine. A gasoline engine of suitable type for this purpose can be bought for from $100 to $125. Belting, relief valve, and such connections as necessary would cost about $15.

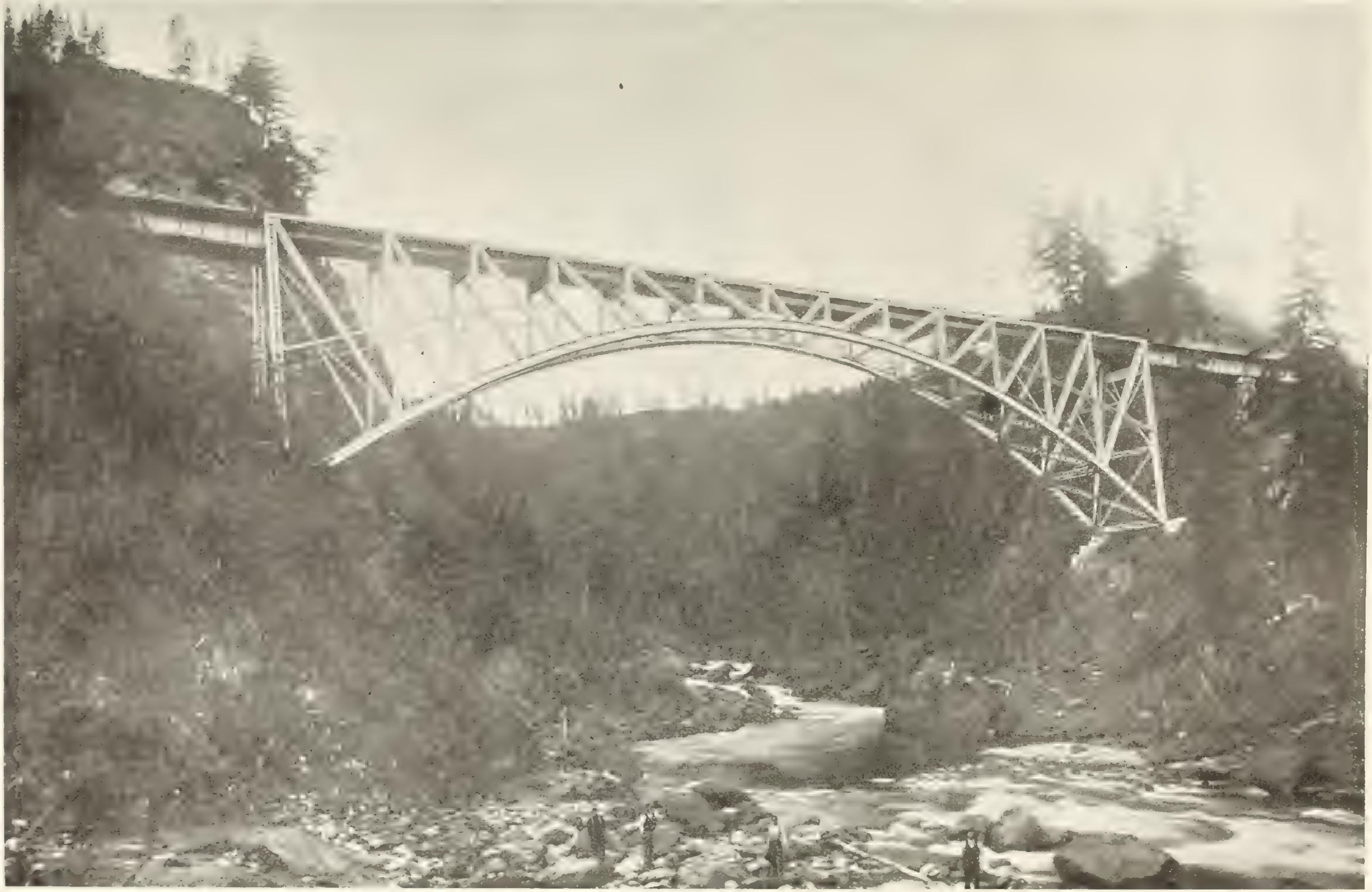
This equipment will supply 25 gals. a minute working against a head not exceeding 346 ft. (To the actual vertical head, 1.5 ft. must be added to each 100 ft. of pipe, to compensate for friction.) The estimate of pumping costs follows:



Plan of water supply.

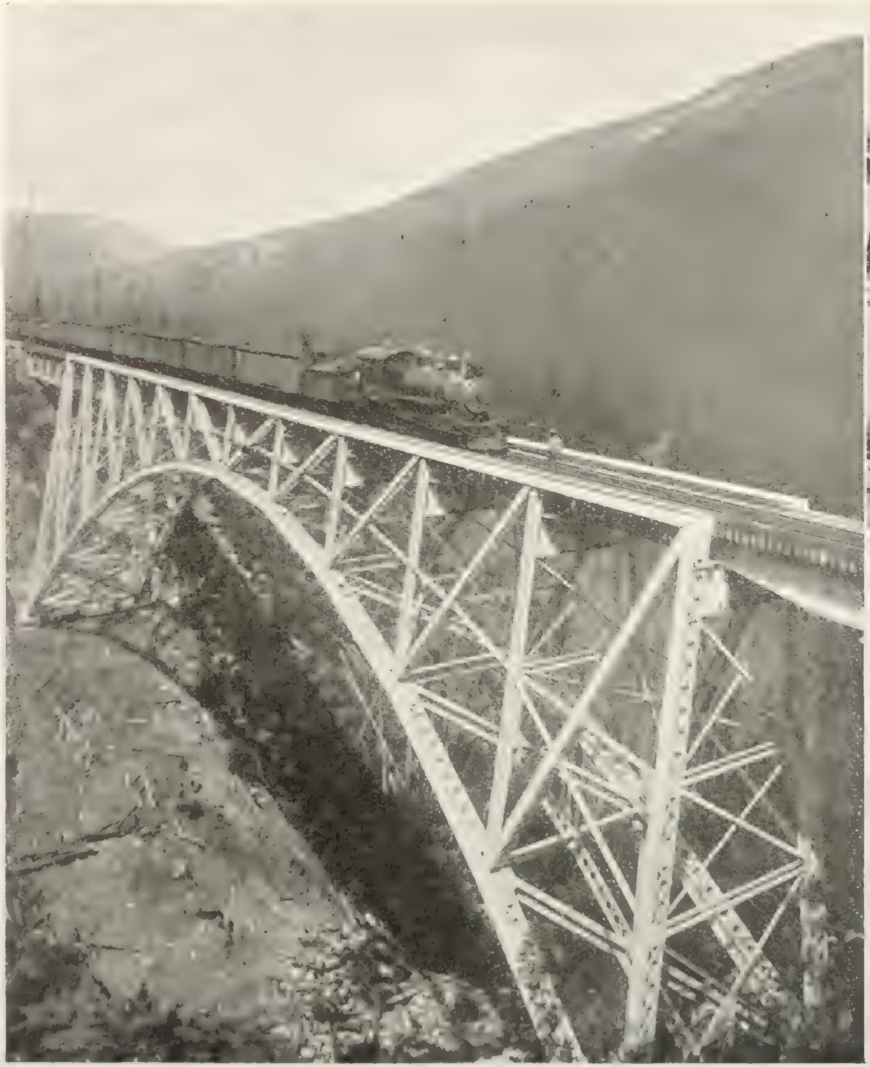
Cost of equipment to be credited to the job:	
10 2-in. gate valves, at $3	$ 30.00
50 1-in. globe valves, at 75c.	37.50
50 T's, 2 ins. to 1 in., at 20c.	10.00
400 ft. of hose, at 15c.	50.00
Deming single-acting triplex pump	125.00
4 h.p. gasoline engine	125.00
Belting relief valves, etc.	15.00
Incidental accessories	50.00
	$ 442.50
Charge 0.17 per cent. of equipment cost a day for depreciation and upkeep for 213 days	$ 163.85
15,000 ft. of 2-in. pipe, rental and freight, at $0.3¼ a foot	487.50
Labor for placing and removing pipe line and equipment:	
Hauling 15,000 ft. of pipe pumping equipment and accessories 8½ miles, 30 tons at 50c. a ton-mile	127.50
Laying and removing 47,000 ft. of pipe at 50c. a 100 ft.	235.00
Setting of pump and engine twice	20.00
Cost of pumping, including fuel and labor, say, 160 working days at $5	800.00
	$1,833.85
Add 10 per cent. for contingencies	183.39
Net cost of water for 80,000 sq. yds. of concrete pavement	$2,017.24
Net cost of water to a square yard of concrete pavement	$0.0252

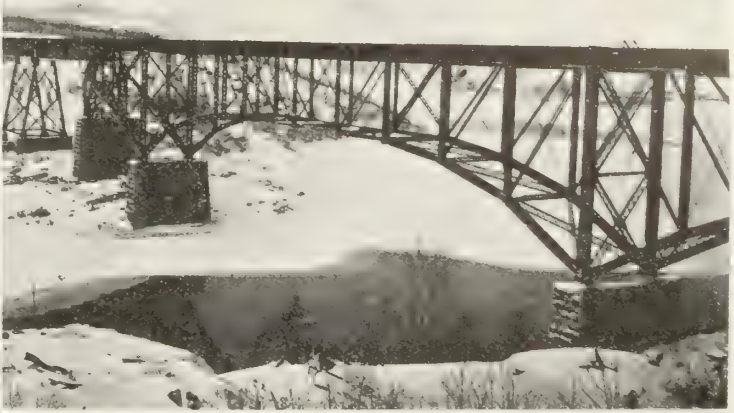
Arch Bridge over the Salmon River, B.C.

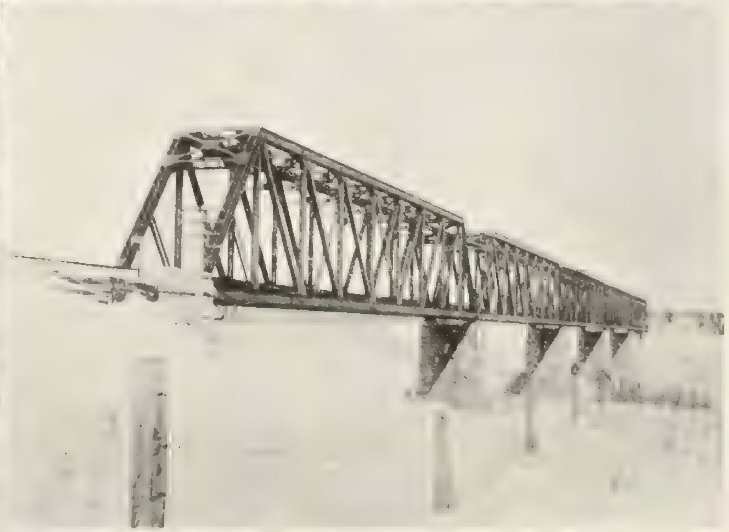


On the Canadian Pacific Railway, 137 miles east of Vancouver, B. C., is an arch bridge spanning the Salmon River. This bridge was built in 1893 by the Dominion Bridge Company. It has a span of 270 ft. and a rise of 50 ft., the depth being 60 ft. 3 ins. at the ends and 10 ft. 3 ins. at the centre. The trusses are 16 ft. apart at the centre line of the top chord but are placed in inclined planes on a 1 in 10 batter. The approaches consist of plate girder spans, making the total length of the bridge 490 ft. and the total weight of the structure 388 tons, the arch proper contributing 317 tons of this weight.

Three Types of Railroad Bridge Designs


The Surprise Creek arch bridge near Glacier, B. C.


The St. Maurice cantilever bridge.


The Three Rivers C. P. R. crossing.

The Surprise Creek arch is another Canadian Pacific bridge. It is located near Glacier, in the Selkirks, about 435 miles east of Vancouver. It was built in 1897, and has an unusual feature in its lack of symmetry, one pair of shoes being about 22 ft. lower than the other. The batter in this case is 1 in 8, the greater end depth 92 ft., the centre depth 16 ft., and the width between centre lines of top chords also 16 ft. The length is 290 ft. 4½ ins. between end pins; the weight of the arch is 520 tons, and the total weight, including the approach spans, 605 tons.

The St. Maurice cantilever bridge, also illustrated, was built in 1895 for the Great Northern Railway of Canada, now forming part of the Canadian Northern System. The nominal dimensions are: total length, 400 ft.; channel span, 250 ft., and width, 20 ft. The bridge is situated near Grand'Mere, Quebec. The steel in the cantilever weighs 305 tons, to which the trestle approach adds 64 tons.

The Three Rivers crossing by which the Canadian Pacific spans the St. Maurice on the main line from Montreal to Quebec consists of five 220-ft. spans built to the standard C. P. R. specifications of 1905. The centre to centre width is 18 ft. 6 ins., and the weight of each span is 380 tons.

Gauging the Flow in Sewers

IN designing new relief or intercepting sewers and sewage treatment works it is becoming a more common practice to gauge the flow of sewage in existing sewers. The measures adopted by a number of cities in sewer gauging were described recently by Engineering and Contracting as discussed before the Boston Society of Civil Engineers.

The Massachusetts State Board of Health uses a comparatively simple and inexpensive type of recording gauge. It is described substantially as follows by Edward Wright, Jr.

The gauge is used mainly for measuring sewage at disposal works where the sewage passes over a weir, although it has been used in the measurement of stream flow and in the measurement of the flow of trades and wastes where it is possible to install weirs.

The gauge, Fig. 1, consists of a copper float to which a rod and pencil are attached, and a cylindrical drum, which is caused to revolve by an ordinary clock mechanism. The float rod engages in two brackets which are provided with roller bearings. The paper upon which the diagram is indicated is wrapped around the drum and held in place by pins at the top and bottom and by rubber bands. The elevation of the starting point in relation to the crest of the weir is obtained by means of a hook gauge. The actual head on the weir is indicated.

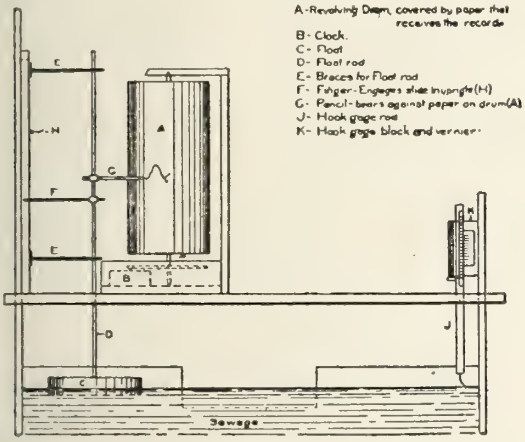

A-Revolving Drum, covered by paper that receives the records
B- Clock.
C- Float
D- Float rod
E- Braces for Float rod
F- Finger-Engages slide in upright (H)
G- Pencil-bears against paper on drum (A)
J- Hook gage rod
K- Hook gage block and vernier.
A
B
C
D
E
E
F
G
H
J
K
Sewage

Fig. 1.—Automatic gauge used by Massachusetts Board of Health.

The moving parts of the gauge are constructed of brass, and while corrosion starts in very rapidly, the gauge is so constructed that little or no difficulty ensues from this cause in its operation. The clock is so constructed as to run seven or eight days, and except when weather conditions interfere, the gauge will run without attention for this length of time.

Owing to the great amount of moisture which at times rises from the sewage in the tanks where the edge has been used, it has been found impossible to produce a pen-and-ink diagram, and, in fact, the moisture rising at certain sewage disposal works has been so great that the paper would be torn by the pencil, and to overcome this the very best quality of paper has been used.

The most remarkable feature about this gauge is that its cost, exclusive of the weir, is only about $25 or $30, which includes about $4 for the clock mechanism.

The gauge is very sensitive and, in fact, the effect of matters rising with gas in the sewage in the measuring tanks under the float has frequently been indicated. Most of the inaccuracy is due to the floating matters in the sewage, which displace the float and tend to clog the weir.

The flow of the sewage at the sewage disposal works at Marlboro, Mass., is measured by means of a trapezoidal or Cippoletti weir, placed in a channel leading to the sedimentation tanks. The sewage enters the screen chamber through a long cast-iron pipe siphon, passes through a coarse bar screen, and along a channel 7 ft. wide to a trapezoidal weir. The crest of this weir is 2 ft. long and the sides have a batter of 1 in 4. The crest of the weir is set 18 inches above the floor of the channel. The weir itself is made up of 6-in. by 3½-in. by ½-in. steel angles bolted together and set in concrete. The inner edge or crest is planed to a true, sharp edge. The depth of flow over the weir is measured either directly by hook gauge or rule, or by means of a recording gauge of the Bristol type. This description is by Frank A. Marston.

The original plan provided a cast-iron pipe well, with connection to the channel a few feet above the weir, in which the diaphragm was suspended. The recording gauge was fastened to the wall of the screen house. After operating the plant for several months it was found that considerable sludge and scum collected in the diaphragm well and proved to be objectionable, although it may not have had any serious effect on the diaphragm or on the operation of the recording gauge. Because of this collection of scum the diaphragm was removed from the well and was suspended in the channel itself, which arrangement has proved more satisfactory.

The average depth of flow is obtained from the circular chart by the use of a circular planimeter, and the quantity discharged by the trapezoidal weir is computed from the following formula:

$$Q = 3.366\ 2/3\ L\ h^{3/2}.$$

Q = quantity in cu. ft. per second.
L = length of crest of weir = 2 ft.
h = head on crest in feet.

In the design of the plant, the possibility of using a Venturi meter or some other form of measuring apparatus was considered, which would obviate the necessity of constructing an open channel with its attendant difficulties due to the deposition of solid matter, but it was felt that the city would not be justified in going to additional expense for this purpose.

The trapezoidal form of weir was chosen because of the great variation in flow to be measured. During dry weather single daily flows have been recorded as low as 150,000 gallons in twenty-four hours, and during the spring flow has reached as high as 2,300,000 gallons in twenty-four hours for a single day.

In studying the operation of the plant, it was found desirable to know the number of doses discharged by the automatic siphon from the dosing tank each day, and to obtain this information Mr. George A. Stacy, the Superintendent, installed another Bristol gauge in the dosing tank. This new gauge has operated in a more satisfactory manner than the other, perhaps partly due to the fact that the diaphragm is immersed in settled sewage. The charts obtained from this new gauge have been satisfactory and of considerable value. They show the rise and fall of the sewage level in the dosing tank, and are used not only as a check on the quantity of sewage, but especially to determine the quantity applied to the various filter beds.

After about one year's service, a new rubber diaphragm was installed in the screen chamber gauge. The old diaphragm appeared to have been attacked by something in the sewage, possibly sulphides, which partially rotted the rubber.

From the beginning of the operation of the recording gauge in the screen chamber, the attendant has kept daily readings of the depth of flow over the weir, measured directly at a point a short distance above the weir. The attendant was instructed to take these measurements at approximately 4 o'clock each afternoon, and from the data thus obtained it has been possible to check the readings of the recording gauge and to fill in the records for the periods that the gauge was out of commission.

A number of daily records were selected as being representative of the variations in flow, and from these a curve was plotted showing approximately the percentage which the 4 o'clock p.m. rate of flow is of the average for the entire day for varying rates of flow. By means of this curve the average daily flow was estimated, having as a basis a single measurement made at 4 o'clock in the afternoon. The results have been reasonably close and furnished a fair check on the working of the gate. The Marlboro sewerage system is largely on the separate plan, so that the variation in flow of sewage through the day is quite regular for certain average flows.

The experience with this type of recording gauge at Marlboro, although somewhat adverse, is not of a sufficiently serious nature to prevent the gauge being used in other places. The experience seems to point out, however, that it is very important that the gauge be thoroughly tested at the factory before it is installed, and that every precaution be taken to make sure that the tube connecting the diaphragm with the recording gauge be absolutely air tight. It is also of advantage to have the diaphragm immersed in as nearly clear water as possible, although the gauge has operated successfully in what might be called thick sludge. Apparently septic sewage has some action on the rubber of the diaphragm, requiring its renewal perhaps once a year, but this can be easily done by a man of average mechanical ability and should not be a source of serious trouble. Where a slight leak does occur in the pressure tube or in some other part of the mechanism, it is exceedingly hard to locate and much harder to remedy. On the whole, the records obtained in Marlboro have been very valuable, and experience seems to justify this type of instrument as against a more expensive type, under the conditions at this particular plant.

Some time ago Mr. Frank B. Sanborn had occasion to install a recording gauge for measuring the flow of the sewage of the city of Providence, R. I., and some features of the installation, here described, are somewhat unusual.

The flow of sewage is about 24,000,000 gals. a day, about one-tenth of which comes from a gravity system, the remainder being lifted 27 ft. at a point about 2,000 ft. from the disposal works.

The pumping plant consists of three Holly engines, each of which is connected with two centrifugal pumps, whose combined capacity is 43 million gallons a day.

The large size of these units necessitates a system of intermittent pumping during periods of small flow, as at night, or on Sunday, the sewage at such times being allowed to rise to a certain height in the large sewer leading to the pumping station, when the pumps are started, and operated until a certain low level is reached.

The discharge from the pumps, together with that from the gravity system, flows through an 88-in. conduit into a semi-circular open mixing channel, 150 ft. long and 16 ft. wide. In this channel are placed 20 slate baffles, set 6 ft. apart on alternate sides, and projecting 6 ins. beyond the centre line of the channel. From this channel the sewage flows directly to the four large sedimentation tanks.

Briefly, the conditions to be met with were as follows:

The location of the weir was limited to the mixing channel, in which the baffles caused a very great agitation of the sewage.

The weir had to be higher than the level of the sewage in the tanks, to be independent of variations in the method of operation.

It had to be as low as possible, to avoid increasing the work of the pumps.

The opening of the weir had to be sufficient to accommodate a flow of 120,000,000 gallons a day.

The recording device had to give an accurate record of the flow, without being so delicate as to be disturbed by momentary variations in height, due to currents in the mixing channel.

Owing to the sudden fluctuations caused by starting and stopping the pumps, the chart had to be in terms of volume rather than of height, so that the total flow each day could be determined by the use of the planimeter.

Since the weir would not correspond to the requirements of any formula, the actual flow had to be determined by experiment.

A location was chosen at the last baffle in the mixing channel, and a 10-ft. rectangular weir was placed at this point, having its crest 9 inches above the level of the sewage in the tanks, and 1 inch above the top of the baffle.

This greatly reduced the agitation in the mixing channel, but it was thought that the fall over the weir would give as good results as the former flow through the baffles.

By placing the weir at this location and height, no change was made in the conditions at the mouth of the 88-in. conduit leading from the pumps.

At a point 12 ft. up-stream a 3-in. pipe was built into the wall of the channel, 3 ins. lower than the crest of the weir. This pipe was carried into a large manhole, and another pipe was laid from the manhole to a 12-in. stand-pipe. The large amount of water in the manhole prevented the making of a wide line on the chart due to momentary fluctuations in height.

The weir was then calibrated by experiment, the flow being measured in the various tanks of the plant, while observations were made of the height at the weir.

Points were thus obtained at rates varying from two million to seventy-five million gallons a day, and a curve was plotted to show the flow at any given height.

The recording instrument selected was the weir-gauge made by the Hydro Manufacturing Company of Philadelphia. This instrument was intended to record height directly, and in order to get a record in terms of volume, the usual device was employed of introducing between the float and the recording pen a cam or spiral which should be designed according to the formula for this weir. An 8-in. float was placed in the standpipe, and connected by a cord to a counterweighted drum, having a diameter of 5 inches.

On one end of this drum was fastened a sheet-iron disc, 30 inches in diameter, and on the surface of this disc, raised on blocks ½ in. high, was placed a brass track, whose curve was such that the distance from the centre increased one-tenth of an inch for each million-gallon increase in the rate of flow.

On this track was made to travel a small wheel, whose axle was attached to the lower end of a vertical rod, on the upper end of which was fastened the pen-carriage of the recording device. By this means a chart was obtained which could be reduced to gallons per day by the use of an ordinary planimeter. After the device was in place it was repeatedly checked in amounts up to 7,000,000 gallons, by actual measurement in the sedimentation tanks.

The engineering department of Newton, Mass., maintained sewer gauging apparatus at three of the connections of its sanitary sewer system with the metropolitan trunk sewer near the Charles River for a period of about a year during 1902 and 1903. These gauges are described as follows by Edwin H. Rogers:

The gauges were in the form of a weir, with apparatus to measure the depth of flow, consisting of a float and a connection therefrom which registered the rise and fall of the sewage on a perpendicular revolving drum operated by clockwork. No reduction gear was used, the actual rise and fall being recorded. The drums revolved once a week, requiring the renewal of the record chart every seven days.

The weirs were located in manholes of the sanitary sewers, and as their crests were raised from 1 to 2 ft. above the invert of the sewers, they proved more or less of an obstacle to the discharge of the solid matter in the sewage, retaining a considerable amount of sludge which had to be frequently removed.

Considerable difficulty was experienced in the maintenance of the clocks, principally on account of the dampness which rusted out the hair-springs in their escapements and also tended to promote the growth of mildew in the works in such quantities as to stop them within a month, even though they were entirely enclosed in brass boxes.

The results obtained were in the main satisfactory, owing principally to the care exercised to keep the apparatus in suitable working condition.

In 1906 to 1908 attempts were made by the department to record the flow in three of the main surface drains of its separate sewer system for the purpose of obtaining data relative to the run-off of storm water. In one drain a weir was constructed with automatic registering apparatus, but was a failure, owing to the sand and other wash from the streets interfering with the operation of the apparatus.

In another instance a float was installed in a chamber beside the drain and connected with the invert of the drain by an inverted siphon.

Owing to the amount of rise and fall of the flow it was necessary to use reduction apparatus between the float and the register chart.

This method of measuring the flow could not be considered a success, partly on account of the pipe connection between the drain and the chamber being clogged with sand and other materials, and partly from the difficulay of calibrating the chart for different depths of flow in the drain. The drain was laid on a 5 per cent grade and the flow through it caused apparent fluctuations in the float chamber which vitiated the attempts to obtain accurate records.

The third installation consisted of a float in a 12-ft. by 6-ft. drain, connected by reduction gear with a clockwork recording dial. It was found advisable to use a boat-shaped float of 4-in. plank, some 18 ins. wide and 8 ft. long, hinged by a 10-ft. rod to the top of the drain, which floated smoothly and did not collect rubbish. The clockwork was housed outside of the drain in the open air, thus avoiding difficulty in its maintenance. This apparatus was in operation with fairly successful results for several months.

A self-registering rain gauge was maintained in conjunction with these gaugings of the drains.

The element of time being an important factor in the derivation of run-off data, it is important that the clocks in the apparatus be closely synchronized, a serious problem, owing to environment and climatic changes, unless a system of electric clocks is employed.

After a considerable sum of money had been expended, it was decided that the results obtained did not appear to justify the further expense of maintenance and operation and the gaugings were discontinued.

Various methods have been employed for the measurement of the flow in Brooklyn sewers, and these methods are here described by Edwin J. Fort.

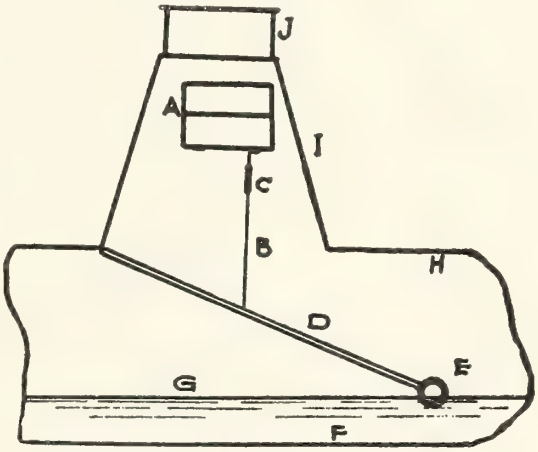


Fig. 2.—Water stage register used in Brooklyn sewers.

Of the several methods employed at Brooklyn the most successful have been the use of the self-recording water stage register and the knife-edge weir.

The self-recording water stage register referred to may be used in all sizes of sewers for domestic flow or storm water run-off. In using this method the hydraulic gradient of the flow is obtained by observation and measurement, as is also the cross-sectional area of the sewer for the depth of flow observed. The value of n, in Kutter's formula, is determined mainly by the exercise of judgment on the part of an experienced observer, in the absence of experimental data. Kutter's formula for velocity is then applied, and by this means the quantity of flow is obtained.

Weir measurements are used in exceptional cases, especially where the entire flow of a drainage area or district can be weired in the out-fall trunk sewer.

The gauge and weir, the description of which follows, have been used in experimental work of this character in a number of drainage areas in this borough, and the results have been quite satisfactory.

Objection may be made that such an estimation of the value of n is liable to considerable error, but even if this were true (of course the greatest care should be taken to estimate the value of n as correctly as our available information permits), the same value is also used in designing sewers, so that any such error would be compensated in the final result.

The equipment used to measure the flow in sewers from the run-off produced by rainfall, consists of two Frieze self-registering water stage registers, and one vertical drum sewer gauge designed by this bureau. Vertical flood sticks or maximum depth of water gauges are also used to determine the maximum flood wave for a given storm.

Figure 2 shows diagrammatically: (A) A water stage register placed on a shelf in an indicated manhole; (B) a copper ribbon passing over the transmission gear of the register; (C) a lead counterweight attached to one end of the ribbon to keep it in tension so that the motion of the float arm will be transmitted to the recording device; (D) an adjustable float arm to which the other end of the ribbon is attached; (E) a copper ball float; (F) represents the inner bottom of a 42-inch sewer; (G) the normal flow line; (H) the inner top of sewer; (I) the manhole, and (J) the head.

The gauges are calibrated by raising the float 0.5 ft. at a time, and noting the value of the movement on the recording device. In this way calibration curves and scales are drawn.

When installing a gauge, the sewer in which it is to be placed is carefully measured, and a curve plotted showing the value of Q for all depths of flow. The gauge is then placed in position, the ribbon attached to the float arm and counter-weight, a blank record placed on the drum and the pen inked and pressed down on the record ready for recording. The ball float is then placed 0.5 ft. from the bottom of the sewer, the position of the pen and the elevation of the float ball being recorded on the blank record; the float ball is raised 5.0 ft. more and the new position of the pen and elevation float recorded. This operation is repeated until the float ball has reached the inner top of the sewer. The elevations are then corrected for the depth of water required to float the ball. By comparing this record with the Q curve, a scale is made so that it will give the value of Q for any position of the pen on the record.

The height of a flood wave is shown on a well sanded vertical flood stick by the sand being washed off as high as the water rises. This gives a very sharp line for the height of the wave, and is of advantage in determining the slope.

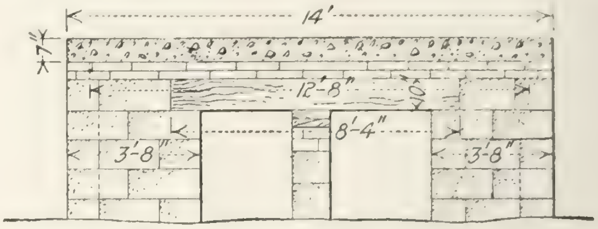
The use of the weir is well illustrated by a concrete example; one of our problems was to determine the infiltration and the maximum and minimum flow of sewage for a large district, the population of which was about 177,671.

To obtain the desired information a weir was used, and the flow automatically gauged during the entire day and night for each day of the week.

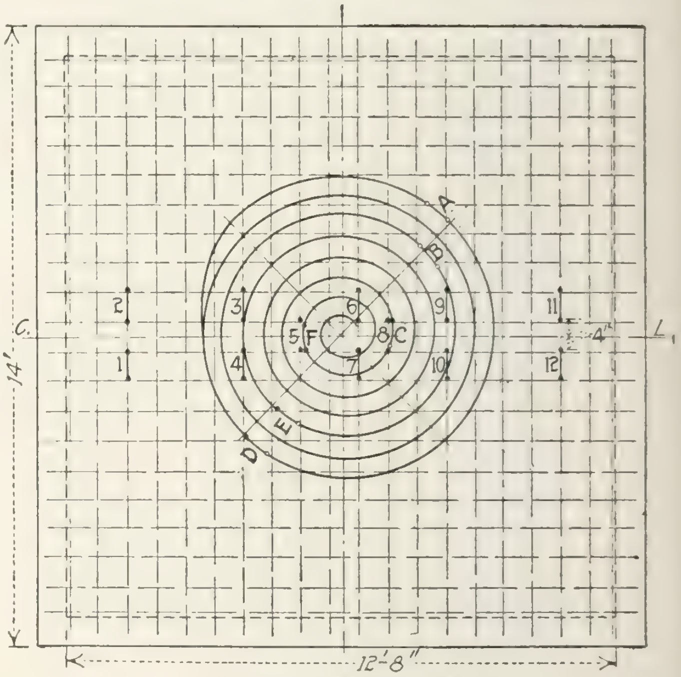
The weir used was located in the out-fall sewer, or outlet flume, and belonged to the sharp-crested type, with end contractions suppressed. The crest length measured 25.84 ft., and the height 2.17 ft. The head on the crest when not affected by storm or snow water varied from .362 ft. at 4.30 a.m. on Fridays to .543 ft. at 3.05 p.m. on Tuesdays.

The device for recording the heads consisted of an automatic water stage register placed over a "basin" pit located just outside of the channel and about 16 ft. up-stream from the weir crest. The pit was connected with the flume by means of a 3-in. iron pipe 3 ft. long, laid on the floor and perpendicular to the side of the approaching channel. The zero for the register was determined by means of a hook gauge and a Y level. The correction for slack motion of the register was determined by the hook gauge to be ½ of 1 per cent.

Bazin's formula, $Q = MLD\sqrt{2GD}$, for suppressed weirs with velocity of approach, was used to plot the results of the investigation. It is suggested, however, that Hamilton Smith's formula, $Q = 3.29\ LH^{3/2}$, for weirs of great lengths, may give more accurate results.

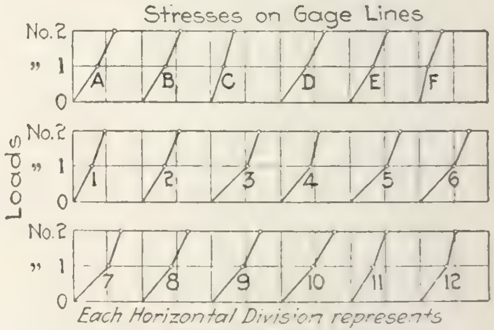


Method of Supporting Slab



Location of Gage Lines

Stresses on Gage Lines



Each Horizontal Division represents 5,000 lb. per sq. in.

Load No. 1 = 382 lb. per sq. ft

" " 2 = 475 lb. " " "

Log of test on special slab.

The total mean flow for 24 hours as indicated by the gauge records was 18,123,000 gals. The total amount of water supplied to the district gauge, according to information received from the Water Department, was 17,767,000 gals. The total amount of ground water (infiltration) a day was 356,000 gals.

Test of a Peculiarly Designed Concrete Slab

The accompanying diagram gives the result of one test of a series made at Minneapolis, Minn., on a reinforced-concrete slab in which an ordinary two-way reinforcement is supplemented by a spiral of reinforcement lying on the cross-rods, described by Engineering News. In building the test slab, four L-shaped corner footings were set up of cement blocks bounded with a rich mortar. A timber beam was then set across the openings, and two courses of brickwork laid all around on the beams and stonework. Upon this brickwork the slab was cast. Subsequently, piers were put in under the centre of each wooden beam. The concrete was a 1:2:4 mix, of which two cylinders averaged 1,775 lbs. per sq. in. at the end of 153 days.

The reinforcement consisted of a ⅜-in. round spiral placed on a two-way reinforcement of ⅜-in. round rods spaced 8 in. c. to c. The spiral was 6 ft. 8 in. in diameter and was held in position by clamping it to two ⅞-in. channels which were so punched as to serve as spacer bars. The lower belt of rods was placed ⅜ in. clear of the forms in the centre of the span and ⅜ in. clear of the supports, the upper belt of rods resting directly on the lower belt.

Gauge points (12 in. c. to c.) were placed as shown in the diagram, those on the straight rods being in the lower belt. Test loads of pig iron were applied 109 days after the slab was cast. The steel deformation shown in the diagram were measured with Berry extensometers.

Personal Mention

Mr. Sydney Comber, building designer, has removed his offices from Greene Avenue, Westmount, to 304-305 Coronation Building, corner of St. Catherine and Bishop Streets, Montreal.

Mr. J. B. Whitney, formerly connected with the Ontario Flexotile Company, Toronto, has been appointed Manager of the Montreal Flexotile Floor Company, 10 Hospital Street, Montreal.

Mr. T. H. White, Chief Engineer, and Mr. M. H. McLeod, General Superintendent, of the Canadian Northern Railway's western lines, have returned to Vancouver from Edmonton.

Messrs. R. S. and W. S. Lea, New Birks Building, Montreal, have been appointed Consulting Engineers in connection with the projected construction of a storage dam at Chatham, New Brunswick.

Mr. A. L. H. Renaud, Manager of Lecky & Collis, Limited, Montreal, has obtained a lieutenant's commission in the 57th Regiment; while Mr. F. G. M. Williams, sanitary engineer, of Montreal, is also going to the front.

Mr. A. S. Fairn, who was for several years in the service of the C. P. R. as engineer in the construction of the irrigation block in the Calgary district, has been granted a commission in the 25th King's Own Scottish Borderers, in which regiment he enlisted at the beginning of the War.

Mr. Edward C. Johnstone has been invited to join the Toronto staff of the Dominion Paint Works, Limited. Mr. Johnstone will relieve Mr. Warner, the eastern representative of the company, of that part of the business pertaining to the repainting of factories, office buildings, etc., which has grown very fast.

At Taber, Alta., the death occurred recently of Mr. H. Y. Parker, formerly City Engineer of Cranbrook, B. C. The late Mr. Parker was born at Norwich, N. Y., in 1876, and graduated as a civil engineer from Cornell University. He went west in 1905, and acted as City Engineer for Cranbrook from 1910 to 1913.

The retirement is announced of Mr. J. H. Kennedy, Chief Engineer of Construction for the Vancouver, Victoria and Eastern Railway. Mr. Kennedy has had a long connection with the Great Northern Railway, and the completion of the Vancouver, Victoria and Eastern from Midway to Hope relieves him of further duties.

Mr. R. O. Wynne-Roberts, an article from whose pen appears in this issue, recently resigned his position as Consulting Engineer to the city of Regina. Mr. Wynne-Roberts was a visitor at the office of The Contract Record last week. We understand that he intends visiting cities in Eastern Canada and the States, and it is possible that he may then proceed to Europe.

Mr. Henry Hadley, B.Sc., the City Engineer of Verdun, Que., has resigned, with a view to going to the front. He hopes to obtain a commission in the 5th Mounted Rifles. Mr. Hadley was a McGill student, and in addition to other engineering work has taken part in surveying for the Grand Trunk Railway. During his term of office with the Verdun Council the district has grown at a very rapid rate, and some large civic works have been carried out under his direction.

Mr. R. S. Lea, of the firm of R. S. & W. S. Lea, consulting engineers, New Birks Building, Montreal, returned recently from a visit to Great Britain and other parts of Europe. He was in Austria when the war broke out, and was detained there for two months, when he and others were exchanged for Austrian subjects in Great Britain. While in the Old Country Mr. Lea was consulted in connection with various power developments and other work in Spain under the control of a large English company operating in that country. He also took advantage of the opportunity to visit a number of the most important water-works and sewerage systems in England, and was afforded special facilities by Government and other officials for making a thorough investigation of the methods of stream pollution prevention and the latest ideas relating to the treatment and disposal of sewage, with particular reference to their employment under conditions prevailing in Canada.

Brockville town officials, including Mr. C. R. Deacon, Chairman of the Water and Light Commission, Mr. E. J. Phillips, Manager, and Mr. G. H. Bryson, Town Engineer, have returned from a visit to several United States cities, where they inspected filtration plants of the types under consideration for use at Brockville. Tenders have been submitted to the Brockville Water-works Department for rapid sand filters, and the officials visited plants of this type at Niagara, N. Y., Erie and Phoenixville, Pa., and Trenton, N. J. They were successful in obtaining valuable information in connection with the operation of these plants.

Major T. A. Starkey, of McGill University, commanding the "A" Sanitary Section, has a very high opinion of the force which is going to France as a sanitary corps. The work will be of a semi-scientific nature, such as protecting the water supply and looking after general sanitation. Practically all the men have had a technical training; most of the privates have gone through a university course, and they include forestry engineers, architects, civil engineers, sanitary engineers, and a bacteriologist. "I have a company of trained men who can do anything, from looking after sanitation to installing a sewage plant or designing and building a bridge," said Major Starkey. "The men have been selected with care, and so many McGill students have offered, from the various branches of scientific work, that I do not think so well qualified a corps of military men has ever left Canada."

Mainly Constructional

East and West From Coast to Coast

On account of difficulties in securing a site for the new sewage disposal plant at Peterborough, Ont., it is unlikely that work will be commenced on the construction of the plant for some time.

Work on the extension of the Dominion Government wharf at White Rock, B. C., will be commenced immediately by the Fraser River Pile Driving Company. The wharf will be completed in about six weeks.

At Kingston, Ont., work has been commenced on the new garbage incinerator. The capacity of the plant will be about fifteen tons a day, and it is estimated that the garbage production of Kingston at the present time is only ten or twelve tons a day.

H. H. Pitts, G. M. Pitts, C. M. Pitts, S. M. Pitts, and M. F. MacLeod have incorporated the Pitts Construction Company at Ottawa, Ont., to carry on the business of an engineering construction company and contractors. The capital stock of the company is $50,000.

Press reports state that the order cancelling the contract of the Norton Griffiths Company for harbour improvements at Courtenay Bay, N. B., has been rescinded. The contract amounts to $7,000,000, and its cancellation was due to the slow progress of the work.

The contract received by the Canadian Locomotive Company, Kingston, from the Russian Government for the manufacture of fifty large locomotives will necessitate increasing the number of employees to 1,000. At present there are 450 men engaged in the manufacture of shells.

The Swedish Crucible Steel Company of Canada, Limited, are putting up a large frame addition to their factory at Walkerville, Ont. They are erecting a cupola that will increase their capacity of gray iron to 120 tons. A number of new machines have been added to the plant.

Work will be commenced shortly on the construction of an electric pumping station in connection with the new water supply for the city of Sydney, N. S. It is understood that the tenders have been received, and that the Board of Works will let the contracts at its next meeting.

The Face Brick and Machinery Company, Limited, has been incorporated at Toronto, with a capital stock of $100,000. The Provisional Directors of the company are P. E. McMillen, W. G. Sunter, L. R. Whiting, E. H. Leighton, and A. J. Langley. The firm will manufacture brick and brick machinery.

Pile driving for the salmon cannery now being erected by the Liverpool Canning Company at Herring's Point, B.C., has been completed by the Fraser River Pile Driving Company, and work on the building will be started as soon as materials, including timbers and lumber from the old Schaake machine shops, are taken across the river.

At Montreal, Que., Hepburn Brothers, Limited, is the name of a firm incorporated recently by W. W. Skinner, W. G. Pugsley, G. G. Hyde, C. M. Palliser, and G. D. Hodge. The company, which has a capital stock of $100,000, has been incorporated to manufacture and deal in all kinds of plant, machinery, and builders' and contractors' supplies.

At Whitby, Ont., the Whitby Brick and Clay Products Company, Limited, has been incorporated for the purpose of manufacturing brick, terra-cotta, drain and sewer pipe, and other clay products. The Provisional Directors are J. F. MacGregor, T. S. H. Giles, W. C. H. Swinburne, W. W Fair, and W. B. Sturrup. The capital stock of the company is $250,000.

A new record was created during the month of May in the laying of granite for the new breakwater at Victoria, B. C. According to statistics issued by Mr. J. S. MacLachlan, Supervising Engineer for the Dominion Government, a total of 7,253 tons of granite blocks was laid in that month, and 19,022 tons of rubble were dumped on the foundations extending seaward. 1,334 cubic yards of concrete were laid in addition.

Delay in the undertaking of water-works construction at Saanich, B. C., has been caused by the necessity of subletting contracts for pipe. McLaren & Company, of Scotland, have been called upon by the Government to use their plant for the manufacture of munitions of war, and in order to fulfil their contract for the municipality of Saanich they have had to arrange with other manufacturers for the production of the pipe.

The great dry dock at Prince Rupert, which is the joint property of the Federal Government and the Grand Trunk Pacific, will be advanced so far that it is expected ship-building will be ready to start by next August. The last pontoon was launched last week, and the upper works are being proceeded with. The dry dock when finished will have cost some $3,000,000, and will be one of the largest, if not actually the largest, in the world.

The Georgia-Harris Viaduct at Vancouver, B. C., has been completed, and although the formal opening may not take place until Dominion Day, it is likely that the bridge will be thrown open to traffic as soon as the engineers have certified that everything is in satisfactory condition. The viaduct cost $500,000, and took two years to build. It is constructed of reinforced concrete throughout, and is declared to be absolutely fireproof.

The German and Austrian prisoners now held in the internment camp at Vernon, B. C., will be put to work on the construction of the Edgewood Road between the Monashee Mine and Edgewood, on the Arrow Lakes. The Dominion Government are defraying the cost of the prisoners' confinement and food, and the Provincial Government will pay those who work twenty-five cents a day. The construction of this road will link up the Arrow Lake country by direct route with the Okanagan Lake and valley.

The contract for a large school on Bloomfield, Fairmount and De l'Epee Streets, Outremont, Que., has been let by the Outremont School Commissioners to Mr. L. Beaudry. The site is 270 x 70 feet, and the building will be of four storeys, with the exterior of brick and terracotta. The main facade will cover a frontage of 258 feet on Bloomfield Avenue. The building will contain twelve classrooms, a study hall, an assembly hall, a reading room, and a museum. The teachers' rooms in the centre of the building can be converted into class-rooms. Bowling alleys, gymnasium, and a swimming tank will be provided.

The laying of concrete will be commenced immediately on the new Toronto-Hamilton road between Clarkson and

Oakville. Grading has been completed on that section. At present there are five construction camps along the highway, employing five hundred men, who are now engaged in grading work. It is expected that the number will be increased to seven hundred when concrete work is started. It is proposed to make the route more direct by crossing an arm of Burlington Bay, either by means of a fill or by a high-level bridge. The idea of a fill at this point has been received with considerable favour, on account of its low cost as compared to that of a bridge.

Following the decision of the court in the injunction proceedings in connection with the awarding of a contract for asphalt, the question of calling new tenders for the supply of asphalt came before the Montreal Board of Control. It was sugested by Controller Hebert that fresh tenders be invited for the supply of asphalt required for this year and also for the supply of asphalt for nine or less years, a condition being that an asphalt refinery be established in the city. The City Attorney, however, advised that trouble might result if a contract were given to a firm other than the Aztec Company. It was therefore decided to postpone the whole question, which is complicated by the fact that the city has ordered 1,500 tons of asphalt from the Aztec Company, and that it may have to take delivery unless the company waives its rights.

The Board of Public Works of Vancouver has approved the City Engineer's recommendation for the construction of sewers in Ward Eight to cost $30,700 and in Ward Five to cost $8,150, but the recommendation was ordered referred to the finance committee for sanction and for provision of the necessary means with which to carry on the work. The proposed work in Ward Eight provides for a sewer on Twentieth Avenue and Sophia Street to St. Catherines Street to cost $15,000, and one on Nineteenth Avenue from Sophia Street to Burns Street at a cost of $14,500. Other sewer work in the ward is estimated to cost $1,200. These sewers are intended to connect with the new sewer completed by the joint sewerage board. In Ward Five it is proposed to lay sewers on Victoria Drive from Thirteenth Avenue to Sixteenth Avenue; on Fourteenth Avenue, from Commercial Avenue to Victoria, and on Fifteenth Avenue, from Commercial Avenue to Victoria Drive, costing respectively $2,400, $2,750, and $3,000. These are to follow up the Carolina Street branch trunk sewer.

The work on the new locks on the St. Charles River, Que., is going on apace, and the contractors, Messrs. Quinlan & Robertson, expect to complete the dam this season, thus permitting the new rail and highway bridges to be started next year. The erection of these locks is one of the largest and most difficult public works ever attempted in Quebec, chiefly on account of the conditions under which the operations have to be carried on. Two parallel locks are to be erected, 450 ft. long and 65 ft. wide, which when completed will permit of sailing vessels with a draught of 20 feet proceeding to the upper basin. The locks and dam will be constructed of solid concrete. About two hundred men are employed, and the plant in operation includes a four-yard dipper dredge, fourteen scows, a 50-h.p. gasoline touring launch, and two travelling scows. There are seventeen hoisting engines and a 30-ton crane employed on the construction work in addition to the concrete machinery. It is estimated that the cost of the locks and dam will be $750,000, and the work is expected to take two years to complete.

Contracts awarded recently to the Turbine Equipment Company, Limited, include one from the city of Brockville for one De Laval 2,500,000-gallon gasoline motor-driven pump and another from the town of Orillia for two De Laval 175-h.p. multi-stage motor-driven centrifugal pumps with a capacity of 1,200 Imperial gallons a minute each. These pumps will work against a total head of 315 feet, and will be directly connected to Canadian Crocker-Wheeler variable speed motors.

An electric water-level indicating apparatus has been used for the purpose of indicating the tide level to dredging vessels off shore. The apparatus is fixed on a timber dolphin about half a mile from shore, and consists of a 25-volt Walker Horrocks automatic electric lighting plant driven by a gasoline engine, with accumulators to supply the current to five differently coloured lamps. A float in a standpipe under the timber dolphin operates a number of switches, and every six inches of difference in the level of the water causes the switches to light up different combinations of lamps in accordance with a pre-arranged code. These various groupings of coloured lights indicate levels from zero to 19 ft. 6 ins. The plant is entirely automatic in action, and a time-switch is employed to switch off the lights in the daytime. Messrs. Gent & Company, Limited, of Leicester, England, recently completed this interesting application of their water-level indicating apparatus in connection with dredging work being carried out by an English firm.

The firm of M. Beatty & Sons, Welland, Ont., were successful recently in obtaining an order from the War Purchasing Commission for five carloads of material handling machinery, including hoisting engines, derrick irons, turntables, centrifugal pumps, and clamshell buckets. These machines will be used by the Overseas Construction Corps in Europe. As an evidence of the firm's ability to make prompt shipments of this class of machinery, we are informed that while the order was received on May 29th the machinery was forwarded, knocked down and packed for ocean shipment on June 1st.

Trade Inquiries

The Weekly Report of the Department of Trade and Commerce contains the following inquiries relating to Canadian trade. The names and addresses of the firms making these inquiries can be obtained by those specially interested in the respective commodities upon application to the Inquiries Branch, Department of Trade and Commerce, Ottawa:

732. **Wrought iron and steel.**—A Middlesbrough correspondent has a demand for wrought iron and steel tubes and fittings, and would like to get into touch with Canadian manufacturers able to supply this material.

733. **Steel sheets.**—A Birmingham firm dealing in military equipment is interested in the supply of steel sheets, nickeled, coppered and brassed, and would like to get into touch with Canadian manufacturers. Samples may be seen at the Department of Trade and Commerce.

743. **Iron and steel goods, etc.**—A firm in South America, large importers of iron and steel goods, desire to hear from Canadian exporters of the following: Iron and steel bars, iron girders, builders' hardware, brass tubing, locks, hammer handles, grindstones, metal screws, files, aluminium, and piano wire.

751. **Wire and wire nails.**—A firm in Birmingham is open to consider samples and quotations f.o.b. Canadian port on wire nails, barbed wire and wire fencing.

752. **Wire nails.**—A Birmingham firm inquires for prices of oval wire nails, brad heads, in 10-ton lot sizes ranging from 1½ inches to 6 inches; also wire slate nails 1½-inch x 10g. and wire lath nails 1-inch x 14g. Samples should be sent, and quotations must be c.i.f. Birmingham.

753. **Steel ingots.**—A firm in Birmingham is open to receive quotations.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Assiniboia, Man.
Plans have been drawn for about 10 miles of plank sidewalk to be constructed for the Township Council. Clerk, Frank Ness, Kirkfield Park.

Brockville, Ont.
A by-law has been passed providing for the laying of tarvia pavement on St. Andrew Street. Clerk, G. K. Dewey.

Plans for a tarvia roadway, curbing, etc., on Court House Avenue, have been submitted to the Town Council. Approximate cost, $5,500. Engineer, G. H. Bryson.

Cobourg, Ont.
The Town Council are considering the laying of concrete or asphalt pavement on King Street. Clerk, B. Ewing.

Eastview, Ont.
Tenders have not yet been called for the proposed sewer on Montreal Road. Report published in our issue of June 16th in error.

The Town Council have received tenders on the construction of about 20,000 square feet of concrete sidewalk, and 2,186 feet of sandstone block. Clerk, H. Washington, Cummings Bridge.

Edmonton. Alta.
Tenders on the construction of a watermain to the site of the stock yards will be called shortly. City Clerk, C. E. F. Cox.

London, Ont.
The Board of Control contemplate the construction of a pavement on Park Avenue. Material not yet selected. Engineer, H. A. Brazier.

Lunenburg County, N.S.
Tenders on the construction of 105 culverts will be received until noon, June 26th, by Hon. H. E. Armstrong, Department of Public Works, Halifax, N.S. Plans and specifications at offices of Road Commissioners, Halifax, Frank Boylan, New Ross, Grover Cole, Druggist, Chester, W. Duff Clerk, Lunenburg, and T. B. Simonson, Bridgewater.

Montreal. Que.
The City Council will receive proposals with regard to the garbage disposal plant until July 15th. Secretary, L. N. Senecal.

Orillia, Ont.
The construction of a pavement on Front Street is being considered by the Town Council. Clerk, C. E. Grant. Estimated cost, $7,500.

Pembroke, Ont.
The Town Council are considering the construction of pavements on Hincks, Berlin, and Murray Streets, at an estimated cost of $8,000. Clerk, A. J. Fortier.

Peterboro, Ont.
The City Council have approved the construction of sewers on Westcott, Lansdowne and Maude Streets, and on Lafayette Avenue. Engineer, R. H. Parsons.

Portsmouth, Ont.
The Town Council have received tenders on the construction of sidewalks on Union Street. Clerk, J. W. Henstridge.

Sandwich, Ont.
Tenders on the construction of a large quantity of concrete paving and curbs have been received by the Town Council. Approximate cost, $31,000. Clerk, E. R. North.

Simcoe, Ont.
The Town Council have received tenders on the construction of macadam roadway and concrete sidewalks and curbs. Clerk, W. C. McCaul.

St. Lambert, Que.
The construction of a trunk sewer and purification plant, estimated to cost about $200,000, is being considered by the Town Council. Engineer, E. Drinkwater, City Hall.

St. Vital, Man.
Plans have been prepared for granolithic and plank sidewalks to be constructed on several streets. Municipal Secretary, J. Desjourdes, Grand Vital.

Strathroy, Ont.
The Town Council contemplate laying watermains on various streets. Clerk, F. W. Atkinson.

Toronto, Ont.
The Commissioner of Works, R. C. Harris, has recommended the purchase of two electrically-driven pumps for the High Level Pumping Station, with a capacity of 7,500,000 gallons each per day.

Tenders on the construction of sewers on Dundas Street from Clendennan Street to Runnymede Road will be received until July 6th by the Board of Control. Commissioner of Works, R. C. Harris, City Hall.

Unionville, Ont.
The Village Council are having plans for a waterworks system prepared by James Loudon & Hertzburg, Engineers, 79 Adelaide Street E., Toronto.

Vancouver, B.C.
The construction of sewers estimated to cost $30,700 is being considered by the City Council. Clerk, W. McQueen.

Verdun, Que.
The City Council are considering the laying of asphalt paving, estimated to cost $63,700, street grading at a cost of $28,000, the construction of curbs and gutters at a cost of $41,000, and the laying of cast iron sewer pipe, to cost $2,800. Clerk, G. A. Ward, City Hall.

Walkerville, Ont.
The Town Clerk, C. H. Robinson, will receive tenders until June 24th for the construction of concrete and asphalt block pavement and cement sidewalks on various streets. Plans and specifications at office of the Town Engineer, Owen McKay. Approximate cost, $9,600.

Wentworth County, Ont.
The County Council are about to start work on Caledonia, Stoney Creek, and Green's roads and the Ninth Concession. Approximate cost, $16,000. Clerk, J. W. Jardine, Court House, Hamilton.

Windsor, Ont.
Tenders will be received until June 30th by W. A. Hanrahan, Secretary to the City Council, for the supply of about 1,000 tons of cast iron pipe and valves, and 160 h.p. boiler equipment.

Winnipeg, Man.
Pavements will be laid on Maple and Osborne Streets by day labor, under supervision of City Engineer, W. P. Brereton. Estimated cost, $30,719.

Woodstock, Ont.
The Town Council have engaged F. A. Barbour, Engineer, Boston, to report on a new water supply. Clerk, J. Morrison.

CONTRACTS AWARDED

Bridgetown, N.S.
A contract for the construction of sewers for the Town Council has been awarded to Beeler & Peters, Victoria Street, at $4,750.

Listowel, Ont.
The Town Council have awarded a contract for the construction of concrete paving and catch basins to the Municipal Concrete Construction Company, Berlin, at $1.46 and $1.54 per square yard.

London, Ont.
The City Council have awarded a contract for the construction of 18,000 square yards of asphalt pavement on concrete base to Standard Paving Company, Limited, Central Chambers, Ottawa, at $2.28 and $2.33 per yard.

In connection with the installation of turbine pumps at Springbank, the City Council propose to let the contract for motors to Canadian Westinghouse Company, Limited, Hamilton, at $6,400, the contract for waterwheels to Hamilton & Company, Limited, 479 Reid Street, Peterboro, at $7,595, and for pumps to McDougal & Company, 512 William Street, Montreal, at $4,710.

Morris Township, Ont.
A contract for the construction of culverts has been let by the Township Council to W. Ferguson, Belgrave, at $3.70 per cubic yard for abutments, and $2.60 for superstructure.

Ojibway, Ont.
The Town Council has let the contract for concrete pavement to John Dewhurst, Woodslee. Approximate cost, $100,000.

Orillia, Ont.
The following contracts have been let by the Water, Power & Light Commission:—175 h.p. slip-ring motors to Canadian Crocker Wheeler Company, George Street, St. Catharines, at $3,100; pump, piping and meters, Turbine Equipment Company, C. P. R. Building, Toronto,

at $7,335; switchboards and cables, Northern Electric Company, 131 Simcoe Street, Toronto, at $2,565.

Peterborough, Ont.

The contract for the supply of a steam pumping plant has been let by the City Council to the De Laval Dairy Supply Company, Park and Princess Streets, Peterborough. Approximate cost, $20,000.

Quebec, Que.

The City Council have let the following paving contracts:—asphalt and scoria block pavement on St. Louis and St. Foye Roads to Madden & Company, Quebec, at $375 per square yard; asphalt pavement on St. Louis Road to Quebec Paving & Construction Company, 83 St. Joseph Street, Quebec, at $2.75 per square yard; paving on Hamel Street and De Salaberry Hill to Sicily Asphaltum Pavement Company, Limited, St. Viateur Street, Montreal, at $2.44 per square yard; granite block paving on De Salaberry Hill to Madden & Company, Quebec, at $3.75. Approximate total cost, $65,000.

Selkirk, Man.

The Department of Public Works, Winnipeg, have let the contract for the construction of an elevated water tank at the Hospital for the Insane to Chicago Bridge & Iron Works, Amigari Street, Bridgeburg, Ont., at $7,300, and for the installation of a steam pump to General Supply Company of Canada, Limited, 85 Water Street, Winnipeg, at $1,050.

Stratford, Ont.

A contract for the suply of lock joint sewer pipe has been let by the City Council to Brennan & Hollingsworth, 15 South Street, Hamilton, at $25,891.

Toronto, Ont.

The contract for sidewalks and grading at the Technical School, Lippincott Street, has been let to Britnell Contracting Company, Baxter Street.

Vancouver, B.C.

A contract for the construction of a sewer for the Vancouver & District Joint Sewage Board has been let to H. P. Peterson, 207 Holden Building, at $70,055. Tenders on the supply of 30,000 paving brick, 5,000 bags of cement and quantities of sand and gravel will be received by Mr. Peterson.

West Kildonan, Man.

The contract for the construction of two sections of the trunk sewer has been let by the Municipality to Thomas Jackson & Sons, 370 Colony Street, Winnipeg, at $105,727. Balance of contract will be let later.

Winnipeg, Man.

The Board of Control have let a contract for the construction of sewers to the Ontario Sewer Pipe Company, Limmited, Mimico, Ont., at $6,410.

Railroads, Bridges and Wharves

Brant County, Ont.

Tenders will be received until noon, June 30th, by A. E. Watts, Court House, Brantford, on steel superstructure and on reinforced concrete abutments for Fairchild's and Manwaring Creek Bridges. Plans and specifications at office of Engineers, Jackson & Company, Temple Building, Brantford.

Brantford Township, Ont.

Tenders for the construction of two reinforced concrete bridges over Jones Creek have been received by the Township Council. Clerk, J. A. Smith, Court House, Brantford.

Bruce Township, Ont.

Tenders on the construction of two concrete bridges will be received until 4 p.m., June 26th, by J. G. McKay, Underwood, Clerk to the Township Council. Plans and specifications with Reeve Johnson, Lot 2, Concession 7.

Dauphin, Man.

The Municipality will call for tenders shortly on the construction of a steel and concrete bridge, between 100 and 150 feet long, over Valley River. Clerk, J. A. Gorby.

Frontenac County, Ont.

The erection of a steel bridge on the Bath Road, about seven miles west of Kingston, is being considered by the County Council. Clerk, J. W. Bradshaw, Kingston, Ont.

New Brunswick Province .

Tenders will be received until June 25th by J. W. Pugsley, Department of Railways and Canals, Ottawa, for the construction of a subway at Little Metis, on the main line of the Intercolonial Railway. Plans and specifications from the Resident Engineer, Campbellton. Tenders will also be received for the construction of a subway at Hampton, St. John sub-division. Plans and specications at office of Resident Engineer, Truro, N.S., at the Station Agent's office, Hampton, with the Chief Engineer, Moncton, and at the Department, Ottawa.

Puttown, Ont.

Tenders on the construction of a bridge over River Nith will be received until June 30th by A. Watis, K.C., Brantford, Clerk to Brant County. Plans and specifications at office of Engineers, Jackson & Company, Temple Building, Brantford. Reinforced concrete abutments, 18-foot steel span. Approximate cost, $7,000.

Quebec Province

Tenders on the construction of abutments and piers for the St. Henri River Bridge on the main line of the Intercolonial Railway will be received until June 25th by J. W. Pugsley, Department of Railways and Canals, Ottawa. Plans and specifications at office of Chief Engineer, Department of Railways and Canals, Ottawa, with the Chief Engineer, Moncton, N.B., and at office of the Resident Engineer, Levis.

Raleigh Township, Ont.

A report has been adopted by the Township Council, recommending the building of two bridges. Clerk, A. E. Robinson, Charing Cross.

St. Thomas, Ont.

The London & Lake Erie Transportation Company, 574 Talbot Street, contemplate the construction of railroad switches. Manager, G. Warburton, St. Thomas.

Waterloo Township, Ont.

The Township Council have passed a resolution requesting the Ontario Hydro Power Commission to report upon the cost of installing and operating an electric railway between Berlin and Guelph.

Winnipeg, Man.

The City Council are considering the construction of three bridges over the Assiniboine River, at an estimated cost of $460,000. Secretary, M. Peterson.

CONTRACTS AWARDED

Bathurst, N.B

The contract for the construction of about two miles of spur line to the Pulp Mills has been let by the Department of Railways and Canals, Ottawa, to Reid McManus, 105 Church Street, Moncton. Approximate cost, $61,000.

Public Buildings, Churches and Schools

Caribou Island, N.S.

Tenders will be received until noon, July 15th, by A. Johnston, Department of Marine and Fisheries, Ottawa, for the construction of a combined wooden dwelling and lighthouse. Plans and specifications at the Department Agency, Halifax, N.S., at the Post Offices at Caribou River, Pictou, River John, New Glasgow and Stellarton, and at the Department.

Clarkson, Ont.

Tenders on the erection of a four-roomed brick school will be received until June 25th by George Adamson, Secretary to School Section No. 6, Toronto Township. Plans with the Architects, Ellis & Ellis, Manning Chambers, Toronto, and with the Secrteary.

Copetown, Ont.

Tenders on the construction of a school will be received until June 28th by J. A. Armes, Architect, Federal Life Building, Hamilton, and by J. Boughner, Copetown. Brick construction.

Edwards, Ont.

Tenders on the erection of a brick by C. S. Patterson, Secretary to the school will be received until June 26th School Board. Estimated cost, $3,500. Architect, W. H. George, Castle Building, Queen Street, Ottawa.

Fairford, Man.

Tenders on the erection of a combined school and teacher's residence will be received until July 15th by Duncan C. Scott, Department of Indian Affairs, Ottawa. Plans at the Post Office, Fairford, the Indian Offices, Portage la Prairie and Winnipeg, at the office of Inspector S. J. Jackson, Stonewall, Man., and at the Department, Ottawa.

Fire Hills, Sask.

Tenders will be received until July 15th by Duncan C. Scott, Department of Indian Affairs, Ottawa, for the erection of an office building at File Hills Agency. Plans and specifications at the Post Offices at Fort Qu'Appelle, Sask., Balcarres, Sask., Regina, Sask., Lipton, Sask., at the office of Inspector W. M. Graham, Balcarres, and at the Department, Ottawa.

Goodlands, Man.

Tenders will be received until July 10th by A. H. Lewis, Box 8, Goodlands, for the construction of a floor and for painting at Montefire School

Humberstone Townsihp, Ont.

G. M. Tice, R. R. No. 1, Humberstone, will receive tenders until June 25th for the erection of a brick school in School Section No 6. Plans and specifications with Mr. Tice.

Kamsack, Sask.

Tenders on the erection of a combined school and teacher's residence on the Cote Reserve will be received until noon, July 22nd, by Duncan C. Scott, Department of Indian Affairs, Ottawa. Plans at the following Post Offices Yorkton, Sask.; Canora, Sask.; Melville, Sask.; Kamsack; at the Indian Office, Winnipeg, at the office of W. G. Blewett, Indian Agent, Kamsack, and at the Department, Ottawa.

London, Ont.

Tenders will be received until 4 p.m., June 29th, by R. C. Desrochers, Department of Public Works, Ottawa, for electrical wiring and fittings for the Post Office and Carling Block Annex and for the Customs House. Plans and specifications with caretakers of these buildings, and at the Department.

Milton, Ont.

A contract for kalamein doors, steel sash and stairs will be let shortly by the Architects for the new Registry Office, G. M. Molesworth & G. M. West, 2 College Street, Toronto.

Mimico, Ont.

The erection of an additional building at the Victoria Industrial School has been recommended by Superintendent Ferrier in his annual report. Estimated cost, $12,000.

Montreal, Que.

The Sisters of the Good Shepherd, 350 Fullum Street, contemplate alterations to the women's jail, estimated to cost about $5,000. Work to consist of changes and enlargements to the roof.

Newcastle, N.B.

The installation of an electric elevator in the Miramichi Hospital is under consideration. Secretary to Hospital Board, E. A. McCurdy.

Pense, Sask.

Tenders on the erection of a Town Hall will be received until June 25th by H. L. Williams, Secretary to the Town Council. Plans and specifications at office of Storey & Van Egmond, Architects, 1013 McCallum Hill Block, Regina.

Sault Ste. Marie, Ont.

The Department of Public Works, Toronto, are having plans prepared for a Court House. Brick and stone construction.

Sherbrooke, Que.

The City Council are considering the erection of a City Hall, and have authorized the Parks Committee to prepare a report on a site. Clerk, E. C. Gatien.

The Pas, Man.

David Clapp, Secretary to the School Board, will receive tenders until July 10th on the erection of a school, and separate tenders on plumbing and heating. Plans and specifications at office of the Architect, G. N. Taylor, and with MacLean Daily Reports, Limited, 302 Travellers Building, Winnipeg. Estimated cost, $43,000.

Toronto, Ont.

Tenders will be received until June 25th by W. C. Wilkinson, Secretary to the Board of Education, for the erection of an addition to St. Clair Avenue School. Plans at office of Building Superintendent, City Hall. Estimated cost, $30,000.

Tenders for heat regulation at Jesse Ketchum and Rosedale Schools and for repairs and improvements at sundry schools will be received until June 25th by the Board of Education.

Tenders on the heating, plumbing, and wiring required in the erection of the Church of St. Vincent de Paul on Roncesvalles Avenue will be received until June 29th by J. M. Cowan, Architect, 65 Adelaide Street E. Plans and specifications with the Engineer, A. E. Freeman, 301 Manning Chambers.

Tenders will be received until June 30th for midsummer repairs to the Separate Schools. Plans, etc., at office of the Architect, C. J. Read, 203 Confederation Life Building.

CONTRACTS AWARDED

Gifford, Que.

The general and masonry contracts in connection with the erection of a presbytery for the Parish of St. Ignace de Loyola have been let to Celestin Parent, Gifford. Estimated cost, $9,500.

Hamilton, Ont.

In connection with the erection of a lodge hall at 240 James Street N. for T. H. Gould, 236 James Street N., the general, masonry, carpentry, and steel contracts have been let to S. Howard, 231 Mary Street. Other trades not let. Approximate cost, $8,000.

Lundar, Man.

The contract for the erection of a school has been let to Wolver Construction Company, Limited, 288 Smith Street, Winnipeg. Approximate cost, $10,000. Frame construction.

St. Thomas, Ont.

H. Smale, Sparta, Ont., has been awarded the contract for the erection of a school for School Section No. 2. Approximate cost, $3,600.

Strathclair, Man.

The contract for the erection of a school for the Strathclair Consolidated School District No. 284 has been let to Ritchie & Watters, Portage la Prairie. Brick and frame construction, concrete foundation, shingle roofing. Estimated cost, $13,000.

Waterloo, Ont.

The Public School Board have let the contract for the installation of a steam heating system to Weichel & Company, King Street.

Business Buildings and Industrial Plants

Birch Hills, Sask.

Scott Bros. flour and feed merchants, contemplate the erection of a flour mill, with a 36-barrel capacity.

Elmwood, Man.

Work is about to start on the erection of a motion pitcture theatre on Kelvin Street for M. Gonsalves, 160 Eugenie Street, Norwood. Work will be done under supervision of the Engineers, Roberts & Frith, Canada Building, Winnipeg. Brick construction, concrete foundation, ready roofing. Estimated cost, $13,000.

Fenelon Falls, Ont.

The erection of a chemical works is being considered. John Carew, M.P.P., William Street, Lindsay, and Thomas Hodgson are interested parties.

Lachine, Que.

Work has been started by day labor on the erection of a shell factory for the Dominion Bridge Company, Limited, Lachine Locks. Brick and steel construction. Estimated cost, $10,000.

Levis, Que.

J. Turgeon, 18 Carrier Street, is considering the erection of a sash and door factory on Wolfe Street, estimated to cost $5,000.

Macleod, Alta.

The Town Council will shortly commence the construction of an elevator to replace that recently destroyed by fir Clerk, E. F. Brown.

Manor, Sask.

Hogg & Lytle, Royal Bank Building, Toronto, are about to erect a grain elevator here, with a capaciey of about 30,000 bushels. Metal clad construction.

Maxville, Ont.

The Borden Milk Company, Limited, 396 St. Paul Street, Montreal, contemplate the erection of a condensed milk factory here, and will have plans prepared by their Engineer.

Medicine Hat, Alta.

Plans are being prepared for stores to be built for Robert Mitchell, Second Street, at an estimated cost of $30,000. The general contract for the work has been let to M. C. Sackrider, 168 Fourth Street S. E. Bedford stone construction, concrete foundation, felt and gravel roofing.

Montreal, Que.

The Union Brewery, Limited, 592 Cadieux Street, will shortly rebuild their premises, recently destroyed by fire.

Work has been started on the erection of three stores and flats on Masson Street by E. Tetreault, St. Pie de Bagot Street. Estimated cost, $6,000.

Ottawa, Ont.

Prices on reinforcing for the garage being built on Slater Street for M. Landreville, Albert Street, are being received by W. H. George, Architect, Castle Building, Queen Street. Concrete and brick construction. Approximate cost, $20,000.

Tenders for the erection of an agricultural building on the experimental farm for the Department of Public Works, Ottawa, will be received until 4 p.m., June 28th, by R. C. Desrochers, Secretary to the Department. Concrete foundation, stone and brick construction, felt and asbestos roofing. Plans and specifications at the Department.

Quebec, Que.

A. Rousseau, 44¾ St. Joseph Street, is building a store and residence on Grant Street, estimated to cost $3,000. Brick and frame construction, concrete foundation, metal and asbestos roofing.

Riviere du Loup Station, Que.

Work has been started on the erection of a store and warehouse for Thomas Langlois, Lafontaine Street. Brick and stone construction. Approximate cost, $25,000. Architect, G. Ouimet, Rue Eglise, Fraserville.

Toronto, Ont.

G. Cruttenden, 1011 Queen Street E., has commenced work on alterations to his premises. Brick foundation, new store front.

Work is progressing on the store and apartments being built at Davenport and Oakwood Streets by R. H. Penprays, 94 Geary Avenue. Smaller trades are being sub-let.

CONTRACTS AWARDED

Dundas, Ont.

The contract for the erection of a shell testing shop for John Bertram Sons & Company, Limited, Hatt Street, has been let to Dickson Building Company, King

Street. Steel and galvanized iron construction, concrete foundation.

Dundalk, Ont.

The contract for the erection of a hydro-electric sub-station has been let by the Town Council to A. C. McDonell, Dundalk.

Hamilton, Ont.

The contract for heating in connection with the warehouse being built at Cannon and Catharine Streets for Davis Bros., 2 Park Street S., has been let to A. Rodgers & Company, 752 King Street E., and for plumbing to P. A. Moore, 939 King Street E.

Plans have been drawn by F. W. Warren, Bank of Hamilton Building, for a store and residence to be erected at 13 Barton Street E. for H. F. Kirkwood. The general, carpentry, steel and roofing contracts have been let to MacKay Bros., Lister Building. Other trades not let. Estimated cost, $4,000.

Lachine, Que.

J. W. Lepailleur, 43 St. Joseph Street, is erecting a gas house for the Lachine Gas Manufacturing Company, Broadway and 20th Avenue. Estimated cost, $5,000.

Leamington, Ont.

The contract for the installation of a sprinkler system at the premises of the H. J. Heinz Company, Limited, has been let to the Vogal Company of Canada, Limited, 620 St. Paul Street, Montreal.

London, Ont.

The carpentry contract in connection with the erection of stores and apartments for W. M. Gartshore, Ridout Street, has been awarded to L. H. Martyn & Company, 807 Princess Avenue, and the masonry contract to Jack Moran, 923 Maitland Street. Other sub-contracts will be let shortly.

Montreal, Que.

In connection with the stables being erected for J. M. Aird, 165 St. Urbain Street, the contract for the supply of reinforcing steel has been let to G. B. Reynolds, Agent for the Trussed Concrete Steel Company of Canada, 59 Beaver Hall Hill, Montreal.

Work has been started on the erection of a store on St. Paul Street for Masson Estate, 13 St. James Street. The contract for masonry and plastering has been awarded to A. Filion & Frere, 2419 St. Denis Street, and the carpentry, roofing, painting, heating, plumbing and electrical contracts to U. Pauze & Fils Company, 326 Greene Avenue.

Niagara Falls, Ont.

Pinneo & Sons, 131 Oak Street, have let the contract for heating and plumbing in connection with the erection of a box factory on Second Street to G. O. Gray, Queen Street, and the contract for electrical work to Carter Electrical Company, Erie Avenue.

Ottawa, Ont.

The electrical contract in connection with the theatre being erected for B. Stapleton, Queen Apartments, has been let to A. C. Alexandra, 112 Slater Street.

The general contract for alterations to a building on Clarence Street for E. P. Gleeson, Carlton Chambers, has been let to J. Meaghan, 26 Westmount Street.

In connection with the erection of an addition to a store on Elgin Street for S. W. Halliday, 20 Arlington Street, the contract for heating and plumbing has been let to Holloway & Son, 373 Somerset Street, and for electrical work to E. G. Tressider, 58 Second Avenue.

Plymouth Township, Ont.

Work has been commenced on the erection of farm buildings for J. D. Grieve, London Road, by Joseph Randall, Wanstead. Frame construction. Estimated cost, $3,500.

Quebec, Que.

The general contract for the erection of a store and residence for Mme. Gaspard Dion, 696 St. Valiere Street, has been let to J. Patry, 120 St. Mathias Street. Brick and frame construction, concrete foundation, metal and asbestos roofing. Estimated cost, $3,000.

Riviere Du Loup Station, Que.

The contract for the erection of a store and warehouse on Lafontaine Street for Victor Devost, Fraserville, has been awarded to N. Dupont. Brick construction.

Stratford, Ont.

The City Council have let the contract for the trussed steel roof in connection with the erection of a barn on St. Patrick Street, to Stratford Bridge & Iron Works, 91 Erie Street, and for the walls, floors and windows to S. S. Keller, Stratford.

Strathroy, Ont.

The contract for the installation of a sprinkler system in the premises of the Diamond Colonial Furniture Company has been awarded to General Fire Extinguisher Company, 1200 Dundas Street, Toronto.

Toronto, Ont.

Work has been started on the erection of a shed at 282 Carlton Street for F. T. James Company, 29 Church Street, by A. Weller & Company, Limited, 54 Tecumseth Street. Brick construction, felt and gravel roofing. Estimated cost, $4,000.

Allen Bros., Birch Cliff P. O., have commenced the excavation for two stores and apartments to be built at 65-67 Danforth Avenue for E. G. Goodwin, 63 Danforth Avenue. Smaller trades will be sub-let. Brick construction, tar and gravel roofing. Approximate cost, $8,000.

The contract for masonry and concrete work in connection with the erection of an addition to the factory of J. Simpson & Son, 8 Berkley Street, has been let to R. Chalkley & Son, 34 Victoria Street. Work has been started. Approximate cost, $4,000.

Welland, Ont.

The Standard Steel Construction Company, White Block, have commenced the erection of an addition to the plant of the Canadian Billings & Spencer, Limited, Major Street. Machinery for forge and iron work will be required. Estimated cost, $30,000.

Windsor, Ont.

Work has been started on the erection of stores for Soper & Dupuis, 59 Ouellette Avenue, by Blaise & Ramsay, c/o owners. Concrete block and brick construction. Approximate cost, $5,000.

Residences

Allenford, Ont.

J. Wiley is erecting a residence estimated to cost about $3,000. White brick and frame construction, concrete foundation, shingle roofing.

Milton, Ont.

Tenders for the erection of a jailer's residence here for the County of Halton will be received until June 29th by the County Clerk, W. Panton, Milton, and by the Architects, G. M. Molesworth and G. M. Gest, 2 College Street. Brick construction. Plans with Clerk and Architects.

Montreal, Que.

R. Godnito, 680 De Gaspe Street, is building five flats on Clarke Street, at an estimated cost of $3,500.

P. Katz, 451 St. Lawrence Boulevard, has commenced the erection of five flats, estimated to cost $5,000.

Ottawa, Ont.

The owner of buildings on Laurier Avenue, which are to be converted into apartments, is Dr. J. Milton Graham, 227 Clemow Avenue. Report in our issue of June 2nd is in error.

Peterborough, Ont.

Fred Finnie, 146 George Street, has purchased a summer resort at Jubilee Point, and will erect a number of cottages.

Quebec, Que.

E. C. Brochu, 147 St. Cyrille Street, is building a residence on Averdeen Street, estimated to cost $9,000. Brick construction, concrete foundation, metal and asbestos roofing.

Work has been started on the erection of a residence on Aberdeen Street by Leon Nadeau, 105 Franklin Street. Brick and frame construction, concrete foundation, metal and asbestos roofing. Estimated cost, $6,000.

Work has been started on the erection of a residence on First Avenue by Damase Belanger, Domaine Lairet. Brick construction, concrete foundation, metal roofing. Approximate cost, $5,000.

Toronto, Ont.

Work has been started by E. C. Hurlbut, 44 Castlefield Avenue, on the erection of a residence at 136 St. Clements Street. Brick construction, shingle roofing. Estimated cost, $3,500.

Work has been started on the erection of a residence at 97 Balsam Avenue by G. Martin, 100 Wood Street. Smaller trades will be sub-let. Estimated cost, $3,000. Brick construction, shingle roofing.

J. Ross, 302 Wright Avenue, is building a residence at 114 Woodside Street, estimated to cost $3,500. Brick construction, shingle roofing. Smaller trades not yet awarded.

Work on the erection of a residence on Baby Point Crescent has been started by J. A. Ayearst, 325 Davenport Road. Approximate cost, $5,000.

Plans have been drawn for a residence to be built on Spadina Avenue, York Township, by R. A. Thompson, 340 Montrose Avenue. Brick construction, shingle roofing. Approximate cost, $4,000. Smaller trades will be let.

Plans for alterations and additions to eight residences have been prepared for Mrs. Just, 2 Otter Avenue. Tenders are being received on labor only for brick veneering, and on the supply of about 35,000 face brick.

Contracts have not yet been awarded for plastering or painting in connection with a pair of residences being built at 7-9 Mountjoy Avenue by G. J. Custance, 94 Redwood Avenue.

(Continued on page 53)

Tenders and For Sale Department

Brighton Tenders

The date of receiving tenders, in whole or part, for the different trades required in the erection and completion of a Union School Building at Brighton, Ont., has been extended from **June 21 to June 28.**

E. C. BROWNE,
Sec.-Treas. Board of Education,
Brighton, Ont

ELLIS & ELLIS,
Architects,
25 Manning Chambers, Toronto.

Tenders for Culvert Pipe

'Tenders will be received by the undersigned, addressed to Chester S. Walters, Esq., Mayor, Chairman, Board of Control, Hamilton, up to **5 o'clock p.m., Wednesday, June 30th, 1915**, for the following:—

200 ft. of 36-in. Galvanized Corrugated Iron Pipe.

Tenders must be on forms supplied by the City Corporation.

Specifications and form of tender covering the above may be obtained upon application to the City Engineer's Office, Hamilton.

S. H. KENT,
City Clerk.
25

Tenders Wanted

Separate sealed tenders, addressed to J. F. Smythe, Esq., Chairman, Water Commissioners, Windsor, Ontario, and marked "Tender," will be received up to 12 o'clock noon, on **Wednesday, June 30th, 1915**, for:—

(a) 300 tons more or less of 6-in. cast iron water pipe.
    80 tons more or less of 8-in. cast iron water pipe.
    700 tons more or less of 20-in. cast iron water pipe.
    10 tons more or less of specials, consisting of crosses, tees and reducers.

All according to Class C. standard specifications adopted by Canadian Society of Civil Engineers.

(b) Five 20-in. Valves Geared.
    One 12-in. Valve.
    Two 10-in. Valves.
(c) Twenty tons of Pig Lead.

All of the above to be delivered f.o.b. cars Windsor, Ontario.

All pipe must be tested to 300 lbs. before leaving the factory. A certificate of test must be furnished in accordance with the terms of Section 16. No outside weights will be accepted.

A certified cheque payable to the order of the Water Commissioners equal to 5 per cent. of the amount of each section of above tenders must accompany each tender, which cheque, in the case of an unsuccessful tenderer, will be forthwith returned, but in the case of the successful tenderer, will be retained until a satisfactory bond for the due performance of the work is executed, or if such successful tenderer for any reason neglects or refuses to execute a satisfactory bond within 15 days after notice that his tender has been accepted by the Water Commissioners, said cheque will be cashed, and the expense of re-advertising the work required, and any additional cost in connection with the same over the amount of his tender, will be retained from the proceeds of such cheque.

The right is reserved to reject any or all tenders or to accept any tender.

THE WATER COMMISSIONERS,
W. A. Hanrahan, Secretary.
Windsor, Ont., June 18th, 1915. 25

Department of the Naval Service

Tenders for Life Saving Station

Sealed tenders, addressed to the undersigned and endorsed "Tender for Life Saving Station" and accompanied by cheque for 10 per cent. of the amount of the tender, will be received up to noon on **Friday, July 9th, 1915**, for the construction of new buildings for the Life Saving Station at Point Pelee on Lake Erie, Ontario.

Forms of tender with plans and specifications may be obtained on application to the undersigned.

The plans and specifications will also be exhibited in the offices of the District Engineers, Department of Public Works, Toronto and Windsor, and at the present Life Saving Station, Point Pelee.

G. J. DESBARATS,
Deputy Minister of the Naval Service.
Department of the Naval Service,
Ottawa, June 15th, 1915.

Unauthorized publication of this advertisement will not be paid for. 25
81728.

COUNTY OF BRANT

Fairchild's and Manwaring Creek Bridges

Governor's Road

Sealed tenders, clearly endorsed on the outside "Tender for Steel Superstructure Fairchild's & Manwaring Creek Bridges," or "Tender for reinforced concrete abutments Fairchild's Creek & Manwaring Creek Bridges," will be received by the County of Brant up to 12 noon on **Wednesday, 30th of June, 1915.**

The bridges are each of 60 ft. clear waterway, 16 ft. roadway, and Class "A" loading, and are situated within ¼ mile of each other, 3¼ miles south-west of Harrisburg Junction.

The abutments contain 152 cu. yds. and 170 cu. yds. respectively.

Plans and specifications may be seen at the office of the County Engineers, Jackson & Company, Temple Building, Brantford, from whom tender forms may be obtained.

Tenders must be addressed to the County Clerk, County Building, Brantford.

ALAN MAIR JACKSON,
24-25 County Engineer.

Business Opportunity

Will sell Canadian patent rights Baltzer System of constructing inexpensive concrete houses. Only successful system of kind. Most comfortable, durable, attractive, 5-room houses built. Simple apparatus. System has fully demonstrated its worth in the United States. Approved by Government. Write for details immediately.

AUGUST BALTZER,
Severance Building,
21-25 Los Angeles, Cal.

INGERSOLL, ONT.

Tenders for Pavement

Sealed tenders addressed to W. R. Smith, Town Clerk, will be received up to **5 o'clock p.m., July 5th**, for the construction of approximately 7,175 square yards of vitrified brick pavement on a concrete base with 3,500 feet of combined curb and gutter. Plans may be seen at the office of the Town Clerk and at the offices of the Contract Record, 347 Adelaide Street West, Toronto.

The lowest or any tender not necessarily accepted.

ERNEST J. HOLLAND,
25 Engineer

TENDERS

Tenders will be received by G. H. Dickson, R. R. No. 1, Moorefield, or the Engineers, Bowman & Connor, for the construction of a 25-ft. concrete beam bridge between the counties of Perth and Wellington up to **Thursday evening, July 24th**; or will be received at the letting at Listowel, **Friday, 25th, at 1 p.m.**

BOWMAN & CONNOR,
Engineers,
25 31 Queen Street West, Toronto.

FOR SALE

Complete shop outfit, consisting of:—
One 10 x 15 Iron Shaper;
One Pedestal Emery Stand;
One 20-in. Square Base Champion Drill;
One 14 x 28 Fay & Scott extension gap lathe;
One 8 H.P. Gasoline Engine;
Together with belting, shafting, hangers, and pulleys.

This machinery in first-class condition. Box 213, Contract Record, Toronto. 25-27

Fires

East Angus, Que.
A business block belonging to J. A. Planche has been destroyed by fire. Owner will rebuild.

Halifax, N.S.
The boiler plant of T. Hogan & Company, 123 Water Street, has been destroyed by fire. Loss, $10,000, partially insured.

Leamington, N.S.
Gordon Churchill's residence and barns have been gutted by fire. Loss, $4,000, partly covered by insurance.

Moncton, N. B.
The engine room of the Paul Lea Company, 96 Westmoreland Street, has been destroyed by fire. Loss, $2,000, covered by insurance.

North Sydney, N. S.
Fire has destroyed the premises of J. Ingraham, Commercial Street. The loss, $10,000, is partly covered by insurance.

Point Grey, B.C.
Two residences on 20th Avenue W., belonging to C. Hooper, 581 18th Avenue E., have been destroyed by fire. Loss, $10,000.

Residences

(Continued from page 51)

Tenders on excavation and brickwork in connection with the erection of a pair of houses on Kent Road are being received by W. H. Umphrey, 83 Wellesley Street. Estimated cost of buildings, $5,000.

Plans have been drawn for a residence to be erected at Lippincott and Herrick Streets by M. Peters, 617 Queen Street W. Brick construction, shingle roofing. Approximate cost, $4,000.

Tenders for all trades required in the erection of a pair of residences on Gillespie Avenue are being received by W. Melliship, Gilmour Avenue. Brick construction, shingle roofing. Estimated cost, $5,000.

W. Edmonds, 16 Biggar Avenue, is erecting a residence on Regal Road, estimated to cost $4,000. Smaller trades will be let.

H. Lefneski, 423 Roxton Road, is building a pair of residences at 69½ Garden Avenue. Brickwork has been let, and material for other trades will be bought by owner. Approximate cost, $4,500.

Winnipeg, Man.

Work has been commenced on the erection of a residence on Aberdeen Street by S. Abramovitch, 517 McIntyre Block. Brick construction, stone and concrete foundation, shingle roofing. Estimated cost, $4,000.

Work by day labor has been started on the erection of an addition to St. Joseph's Orphanage, Portage Avenue W. Brick and stone construction, concrete foundation, felt and gravel roofing. Approximate cost, $10,000.

CONTRACTS AWARDED

Dundas, Ont.

The masonry and plastering contracts in connection with the erection of two residences on James Street for W. H. Ball, have been let to George James, and the roofing contract to Joseph Rowe. Estimated cost, $3,000 each.

Halifax, N. S.

The general contract for the erection of a residence on Henry Street for George Laidlaw, 57 Edward Street, has been let to Thomson & Theakston, 116 Hollis Street.

Hamilton, Ont.

W. Laking, 324 Victoria Avenue N., has let the general, masonry, carpentry, steel and roofing contracts for the erection of a residence on Emerald Street E. to A. W. Woodhall, King Street. Other trades not let. Estimated cost, $8,000.

Jarvis, Ont.

The contract for the erection of residence and post office for E. F. Jones has been awarded to McCarthy Bros., Cayuga. Estimated cost, $3,000.

London, Ont.

A residence is being built for H. Steele, 940 William Street, by James Finch, 920 William Street. White brick and frame construction, stone and concrete foundation, shingle roofing. Approximate cost, $3,000.

North Bay, Ont.

F. E. Cook, Laurier Avenue, is erecting a residence for Hans Stevenson, 311 Fisher Street. Brick and stone construction.

Medicine Hat, Alta.

In connection with the erection of a residence on Fifth Street for F. Lewis, the general and carpentry contracts have been awarded to M. Fulton, 43 Fifth Street E. E., the masonry contract to G. Worthy, Sixth Avenue S.E., the heating and plumbing to T. Newmarsh, 52 First Street S. W., and the electrical work to Medicine Hat Light & Supply Company, Hull Block. Plastering and painting not yet awarded.

Montreal, Que.

The contract for heating in connection with the students' residence being built at Rachel and DesErables Streets has been let to J. E. Hardy, 666 Papineau Avenue, and the contract for electrical work to W. Rochon, 454 Parc Lafontaine.

The contract for the erection of seven flats on St. Denis Street for M. Masson, 926 St. Denis Street, has been awarded to U. Pauze & Fils Company, 326 Greene Avenue. Approximate cost, $15,000.

Work has been started on the erection of three apartments at 1469 St. Denis Street for Mrs. T. Parent, 25 Poupart Street, by E. Robert, 93 Vitre Street W. Approximate cost, $9,000.

Montreal West, Que.

W. H. Payne & Company, 62 Westmount Avenue, have commenced the erection of a residence for G. T. Horsfall, 35 Ballantyne Avenue. Brick construction, concrete foundation, asbestos roofing. Estimated cost, $5,500.

Niagara Falls, Ont.

In connection with the residence being erected on Bridge Street by Field Bros., 80 Third Street, the contract for heating and plumbing has been let to Tremble & Seales, 66 Queen Street, and for electrical work to Carter Electric Company, Erie Avenue.

Ottawa, Ont.

In connection with the residences being erected on Nelson Street for Donald Fraser, 82 O'Connor Street, the contract for heating and plumbing has been let to J. T. Blythe, Frank Street, and for electrical work to E. F. Armstrong, 55 Second Avenue.

The plastering, painting, and electrical contracts in connection with the apartments being built for F. Argue, 196 James Street, have been let to the general contractors, Alexander & Campbell, 245 Bank Street.

Quebec, Que.

E. Dube, 163 St. Olivier Street, has let the general contract for the erection of a residence to E. Breton, 75 Latourelle Street. Brick and frame construction, concrete foundation, felt and gravel roofing. Estimated cost, $6,000.

A residence is being built on Eighth Avenue, Limoilou, for D. Jean, 159 First Street, Limoilou, by W. Bouchard, 102 Fifth Street. Brick and frame construction, concrete foundation, metal and asbestos roofing. Estimated cost, $6,000.

Sandwich, Ont.

The general contract for the construction of three bungalows for Soper & Dupuis, 59 Ouellette Avenue, has been let to W. H. Jones. Estimated cost, $5,000 each. Hollow tile, artificial stone and brick construction, concrete foundation, shingle roofing.

Toronto, Ont.

Work has been started on the erection of a pair of residences at 254-256 Lee Avenue for J. Price, 126 Lee Avenue, by T. Charlton, 11 Spruce Hill Road. Smaller trades will be sub-let. Brick construction, shingle, felt and gravel roofing. Approximate cost, $4,000.

The contract for masonry and carpentry in connection with the erection of a brick and stone residence for J. Denovan, 191 Grace Terrace, has been awarded to W. R. Partridge, 200 Macpherson Avenue. Estimated cost, $5,000.

The contract for plastering in connection with the residence being erected on Oswald Crescent for G. Andrew, 230 Macpherson Avenue, has been awarded to Brenner & Porter, 226 Beatrice Street, the painting contract to C. H. Coles, 28 Pleasant Avenue, the contract for wiring to E. Warman, 209 Soudan Avenue, and for metal work to C. Murphy & Son, 2013 Yonge Street.

Work has been started by E. W. Biette, 39 Rainsford Road, on the erection of a residence for J. Massie, 6 Howard Street. Smaller trades will be sub-let. Brick construction, shingle roofing. Estimated cost, $5,600.

In connection with the duplex residence being built at Lauder Avenue and Regal Road for W. Connery, Architect, 410 Manning Chambers, the contract for plastering has been awarded to Hanna & Nelson, 273 Rusholme Road, the wiring contract to Toronto Electric Company, 101 Duke Street, and the roofing contract to G. Sinclair, 307 Clinton St. Painting not let.

The masonry contract in connection with the residence being erected at 59 Poplar Plains Road for W. G. Wallace, 94 Admiral Road, has been let to G. H. Weale & Son, 18 Applegrove Avenue, the contract for concrete work to F. Sage, 58 Herrick Street, the heating and plumbing contract to G. Wickson, and the painting contract to H. James. Plastering and wiring not let.

J. D. Naylor, 110 Glenholme Avenue, is building a residence at Northcliffe and Regal Roads estimated to cost $4,000. Smaller trades will be let. Owner's name withheld.

The general contract for the erection of a residence at 337 Delaware Avenue has been let to McDougall Bros., 566 St. Clarens Avenue. Smaller trades, with the exception of carpentry, will be sub-let. Approximate cost, $3,500. Architects, Hunt & Woodburn, Confederation Life Building.

Hall & Son, 6 Park Place, are building a residence at 65 Wells Hill Avenue for Mrs. Eakins. Stone and brick construction, slate roofing. Estimated cost, $6,000.

Uxbridge, Ont.

Work has been commenced on the erection of a residence for T. R. Ferguson by J. A. Orton, Front Street, Orillia. Pressed brick construction. Approximate cost, $6,000.

Contrary to the report published in our issue of June 2nd, the address of the masonry and carpentry contractor for the residence being built for Moore Bros. is Uxbridge, not Orillia.

Verdun, Que.

A. Perrier, 88 Claud Street, has let the general contract for the erection of flats at Woodland and Wellington Streets to L. Levine, 134 Third Avenue. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

Wiarton, Ont.

Work has been started on the erection of a residence on Gould Street for the Congregation of the Anglican Church. The general and masonry contracts have been let to J. H. Robertson, the carpentry contract to A. D. Hurlbut, and the painting contract to W. S. Pope. Approximate cost, $3,000.

Winnipeg, Man.

In connection with the residence being built on Niagara Street by Purcer Bros., 501 McIntyre Block, the contract for heating and plumbing has been let to C. C. Young & Company, Limited, 45 Olivia Street. Contracts for plastering, painting and electrical work will be let later.

Zurich, Ont.

F. Datars, Sr., has let the general contract for the erection of a residence to H. Howald, and the carpentry contract to F. C. Kalbfleish. Red pressed brick construction, concrete foundation, shingle roofing. Estimated cost, $3,000.

Power Plants, Electricity and Telephones

Dartmouth, N. S.

The School Board have instructed the Clerk, A. Elliott, to call for tenders on the installation of a fire alarm system.

Exeter, Ont.

A by-law to provide $20,000 for the installation of a Hydro-Electric system is being considered by the Town Council. Clerk, J. Senior.

Newcastle, N.B.

The Town Council have appointed a Committee to investigate the cost of installing a 24-hour electric system. Clerk, P. E. T. Lindon.

Raleigh Township, Ont.

A by-law is being prepared to provide for the installation of an hydro-electric system. Township Clerk, A. E. Robinson, Charing Cross.

Toronto, Ont.

The Ontario Hydro Electric Power Commission, Continental Life Building, are in the market for one modern revolving field, three bearing, 60 cycle alternator for belt drive, size 300 to 375 k.v.a., three phase, 2,300 volt, with belted or direct connected exciter, preferably with a speed of 300 r.p.m., complete with bed plate rails, rheostats, etc. Price wanted f.o.b. cars.

CONTRACTS AWARDED

A contract for the supply of twisted wire, copper sulphate and batteries has been let by the City Council to W. J. Banks, 112 Peter Street, and for copper wire to Mechanics Supply Company, 80 St. Paul Street.

Late News Items

Dorchester North Township, Ont.

The Township Council have decided to proceed with the erection of three concrete bridges. Clerk, W. B. Lane, Dorchester Station.

London, Ont.

Tenders on the erection of a residence at 366 Maitland Street for Mrs. Simbert, Burwell Street, will be received until June 28th by J. V. Munro, Architect, Bank of Toronto Chambers. Brick construction, concrete foundation. Approximate cost, $4,000.

Montreal, Que.

In connection with the storage sheds being erected on St. Luke Street for the Guaranteed Pure Milk Company, 875 St. Catherine Street West, the contract for reinforcing steel has been let to the Pedlar People, 26 Nazareth Street, and the cut stone contract to J. H. Hutchinson, 64 St. Ambroise Street.

Prince Albert, Sask.

Tenders will be received until 2 p.m., July 2nd, by J. B. Brown, Eighth Street E., for the supply of 1,600 feet of 10-inch sewer pipe and a quantity of bends, junctions and manhole covers. Plans and specifications at office of City Engineer, Angus Smith.

Quebec, Que.

In connection with the store being erected on St. Joseph Street by J. Chevalier, 44 Renaud Avenue, the sub-contract for steel has been let to Eastern Canada Steel & Iron Works, Limited, St. Malo, Que., the roofing and plumbing contract to N. Ferland, 408 St. Francois Street, and the painting contract to Marier & Tremblay, Du Pont Street.

The sub-contract for steel in connection with the warehouse being built on Rioux Street for J. B. Renaud & Company, St. Paul Street, has been let to Eastern Canada Steel & Iron Works, Limited, St. Malo, Que., and the roofing contract to N. Barbeau, 36 Bridge Street. Painting, plumbing, heating and electrical work to be done by day labor, material being purchased by owner.

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2 locomotives, 1 40-ton, 1 55-ton.
15 25-ton Dinkies, standard gauge.
1 18-ton Dinkie, 36-in. gauge.
28 flat cars, 60,000 lbs., want offer.
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1 locomotive crane, 15-ton, 8-wheel 50 ft. boom.
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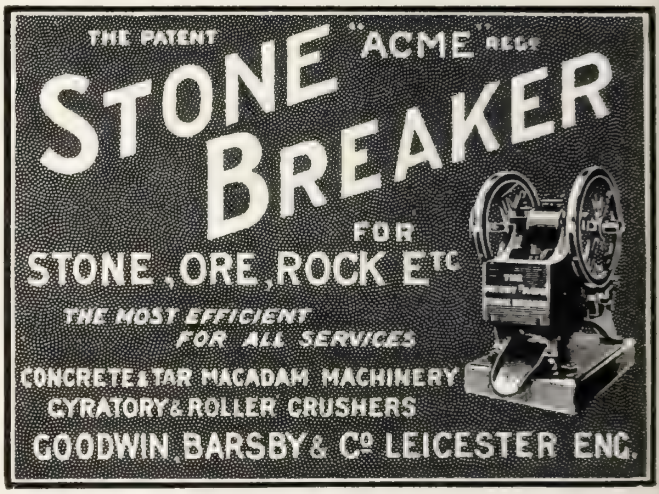
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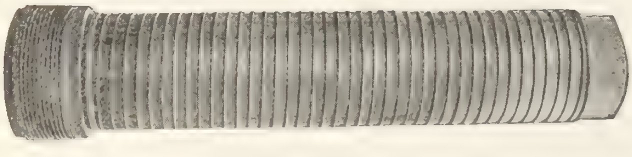

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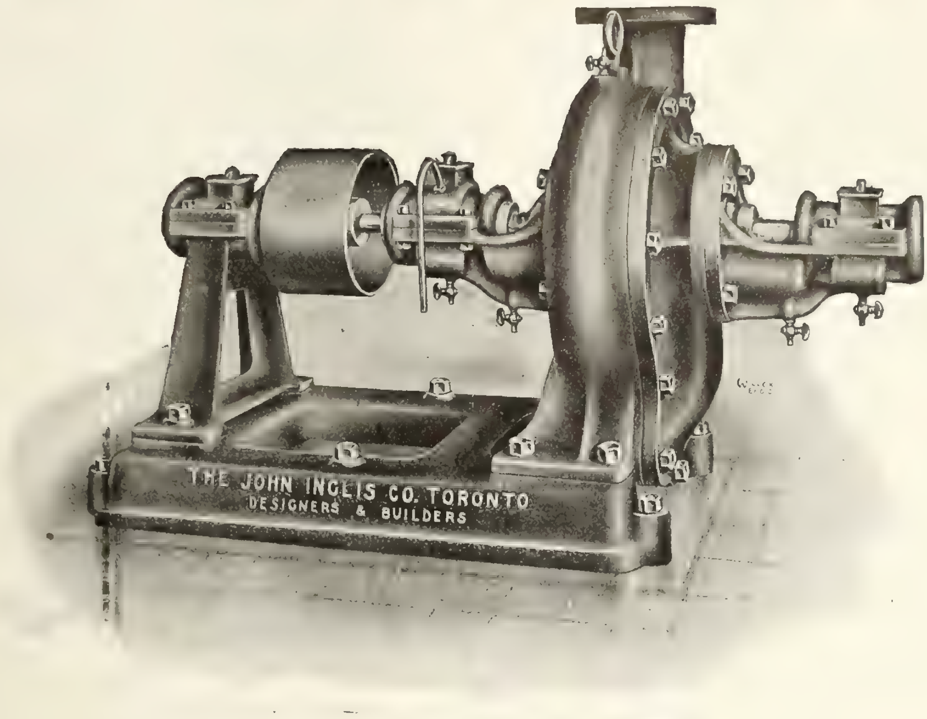

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

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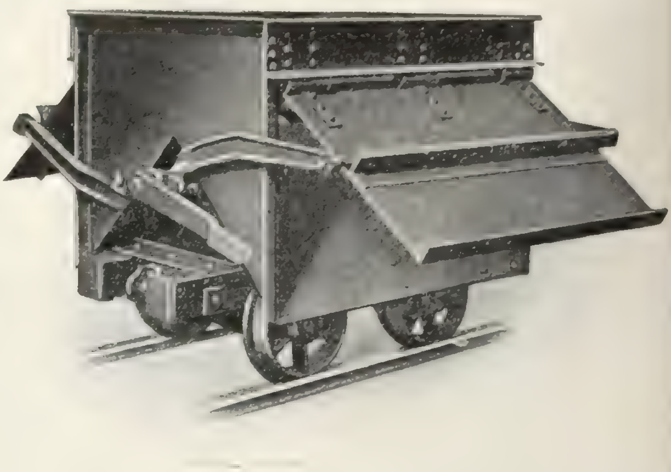
All sizes and designs. Steel Construction.

Mine Cars Industrial Cars



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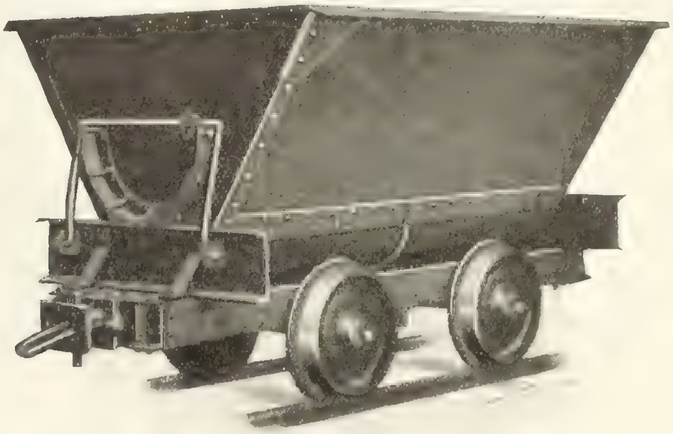

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British & Foreign Building Stones, by John Watson, Published in 1911 at the University Press, Cambridge, England. 483 pages. Price 50 cents.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

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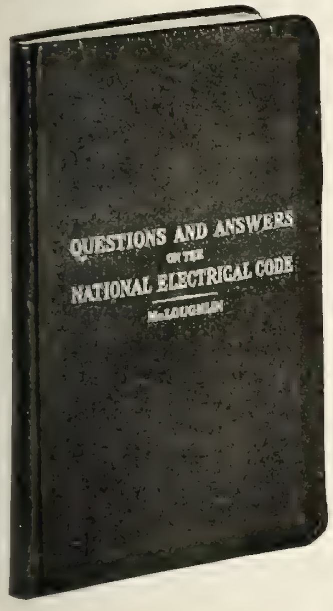

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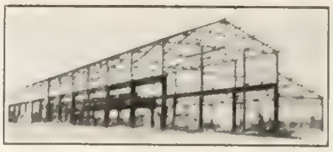

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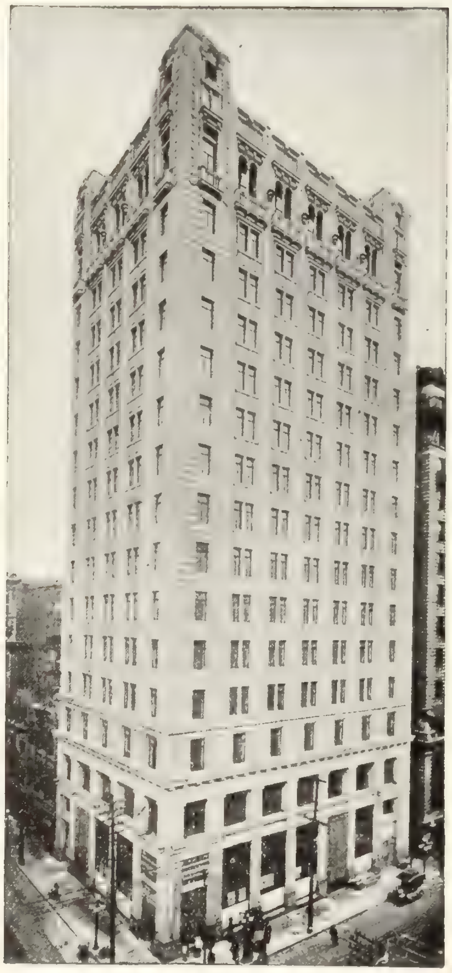

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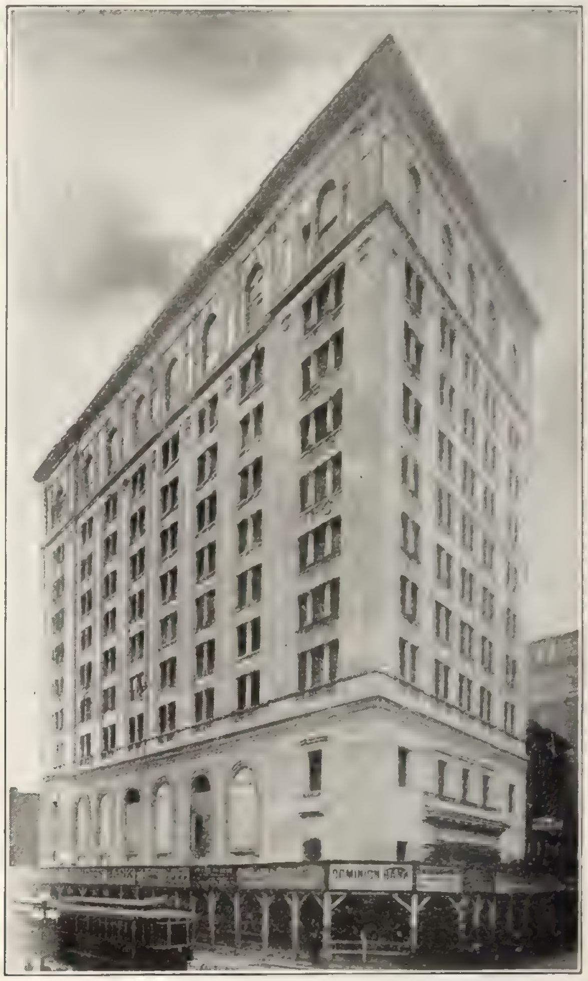

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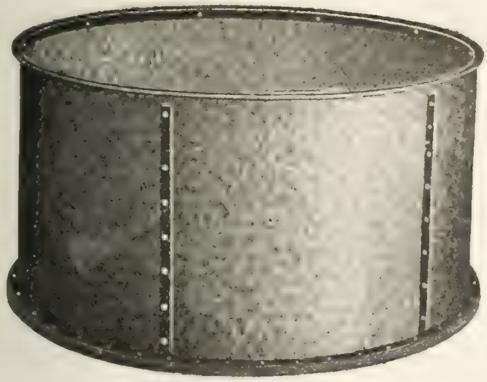

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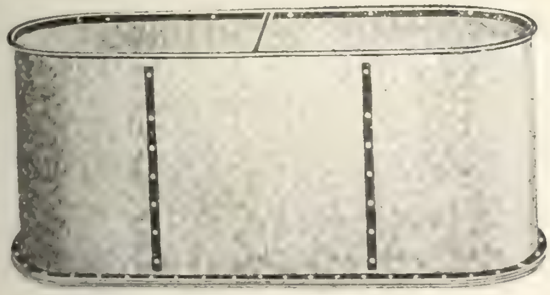

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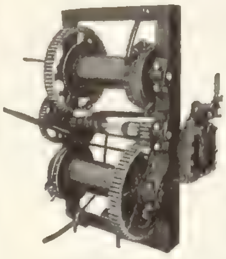

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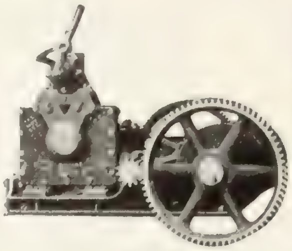

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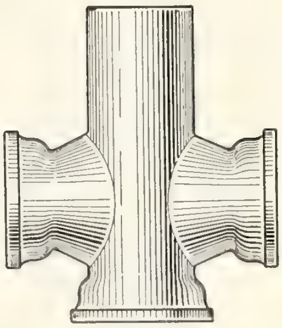

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5 barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.50; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. yd. net cash. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $5.05 per 100 lbs.; Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15½c basis per pound; British manilla, 13c basis; African hemp, 13c; sisal rope, 10½c basis; lath yarn, 9¼c. Boiled linseed oil—in barrels, 82½c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¼-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, ship-lap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 30 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $25; fire clay, $12 per ton.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $5.35 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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White Lead Zinc White

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"Lion Brand" includes the best quality white lead, also oils, stains, shellac, etc. For builders and dealers in builders' supplies, we have a good proposition.

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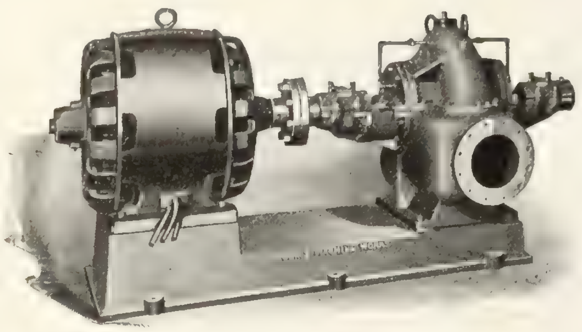

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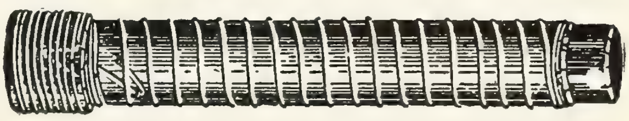

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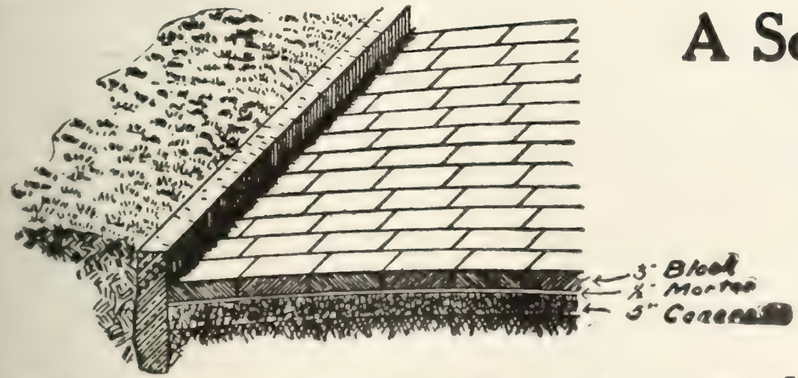

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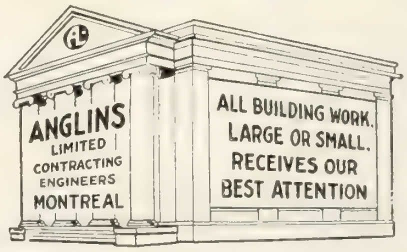

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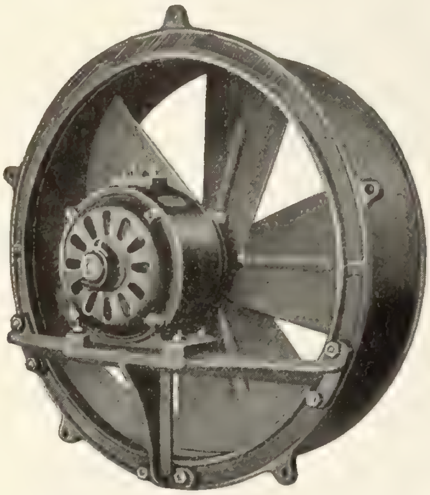

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do more than merely stir up the air. They ventilate thoroughly—remove all objectionable odors and fumes—and lower the temperature.

You can install these disk fans in factories, office buildings, boiler and engine rooms, theatres, restaurants, lavatories, etc. at a very small expense. Simply bolt the frame to an opening in the wall or in a window, and connect the wires.

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In stock, any load, any height.

This is a strong, light, portable "shear" which has replaced the old-type, heavy timber derrick for laying sewer- and water-pipe, setting stones and monuments, erecting poles and columns, loading cars, hoisting materials on new structures, and for many other purposes.

Each leg is fitted with a pointed foot for hard ground and a broad flange for soft soil.

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Bulletin A7 deals with the Morris Worm-Gear Chain-Block.

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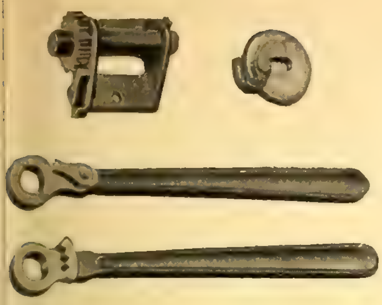

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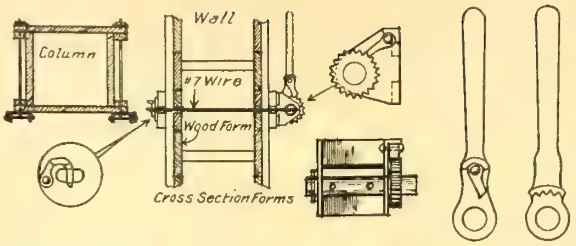

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The one positive means of bracing forms.

Forms clamped with Peerless Wire clamps won't bulge and won't leak at the planking joints when a wet mixture is used.

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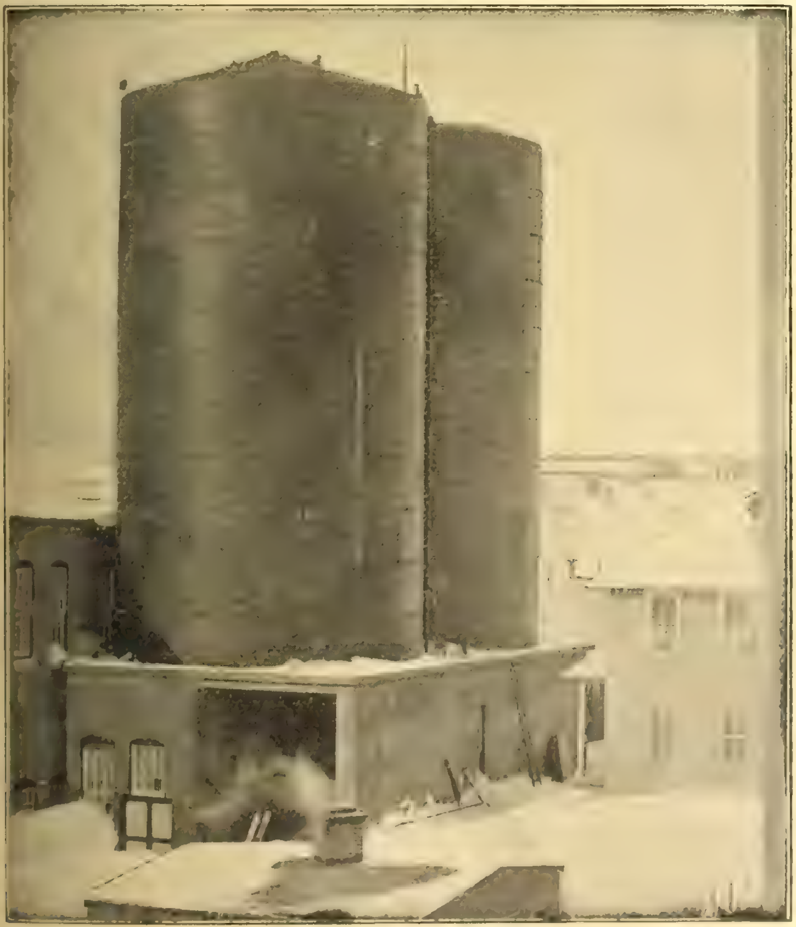

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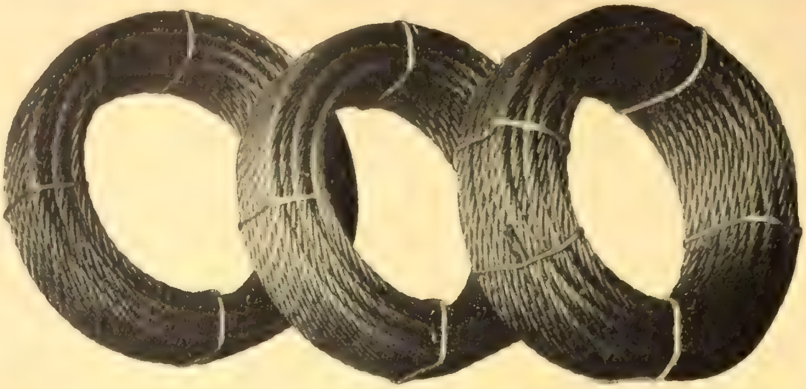

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Stocks carried in Montreal, Winnipeg and St. Catharines.

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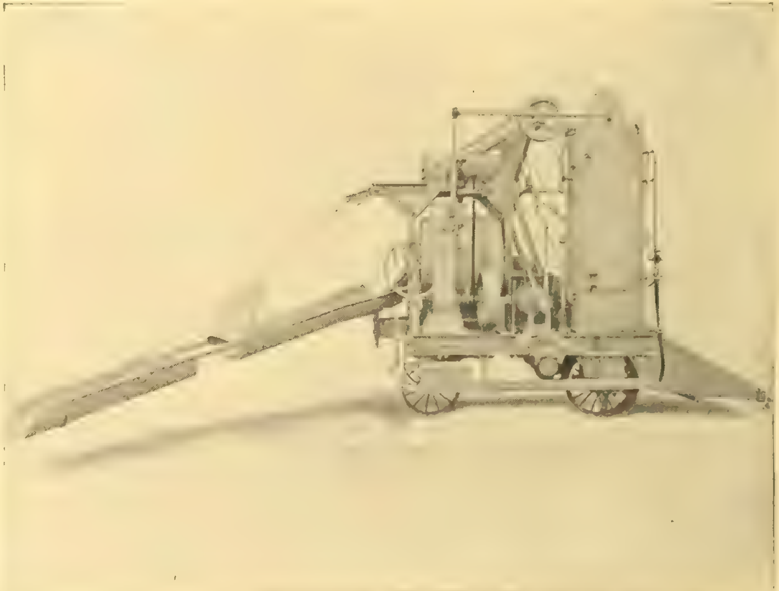
"The Machine with All the Good Features"

This illustration shows Type "S" Ransome Street Mixer equipped with 12 or 15-toot distributing trough with gates.

In designing this machine it has been our object to develop a low first cost, but highly efficient machine.



When desired, this street mixer is equipped with 12 H.P. Gasoline Engine in place of the Steam Engine drive.

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Vol. 29 Toronto, June 30, 1915 No. 26

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Toronto

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements Page 6

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Put a steam plugger to work breaking up the boulders.

Operate it by steam from the shovel boiler or use air if you have it.

In any case send for bulletin K-203 and see what the tool looks like.

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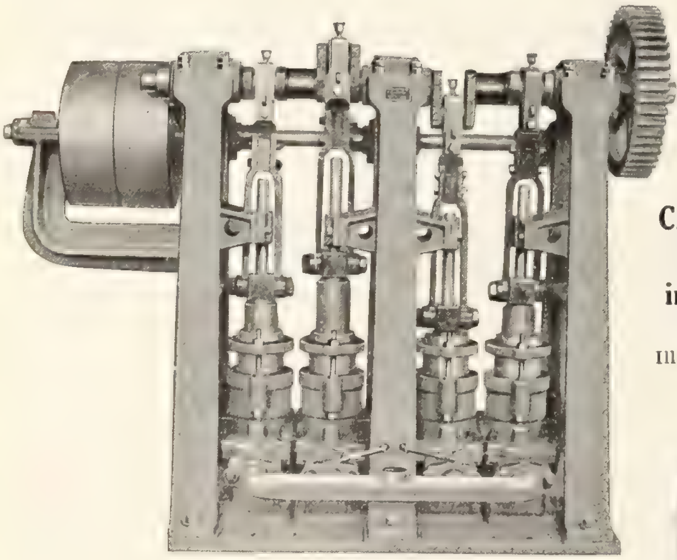
N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.



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For use in connection with filter presses, ensuring a steady pressure and a constant flow of slip to the filter press, and also increasing the capacity of the presses. This pump, the first of its kind to be manufactured, is superior in all points to the two cylinder pump commonly used by clay-workers Saves time in pumping up presses and minimizes the wear and tear on the filter press cloths owing to the total absence of any pulsations. Height 5 feet, floor space 5 feet 9 inches by 3 feet. Driving pulley 18 in. x 6½ in.

We manufacture the most comprehensive range of Clay-Working Machinery in the world.

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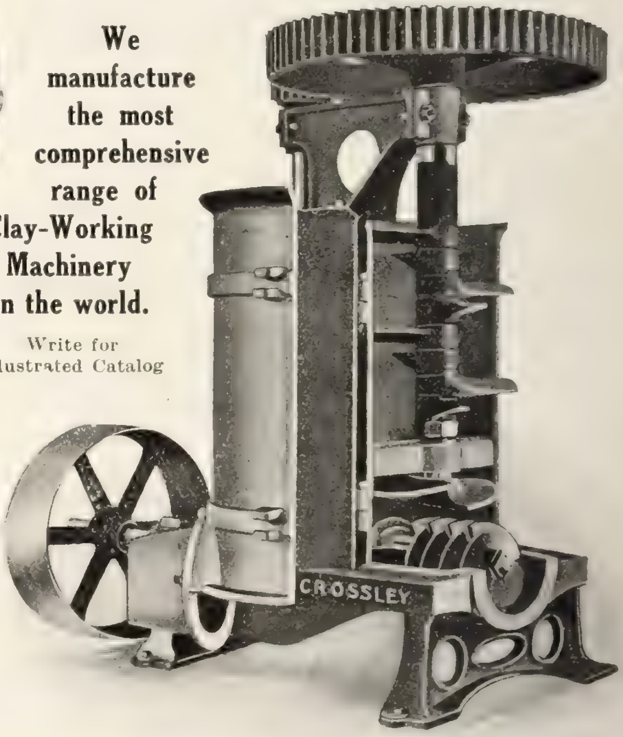

Pugging Machine

The illustration shows the series of knives and worms by which the clay is cut and pressed, eliminating all lumps and air blisters. Made in three sizes with 12 in., 20 in. and 24 in. mills. The latter machine is best adapted for general use, occupies a floor space of 36 inches by 48 inches. Driving pulley 10½ in. x 30 in., capacity 30 tons per day, 14 h.p.

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Toch Brothers'
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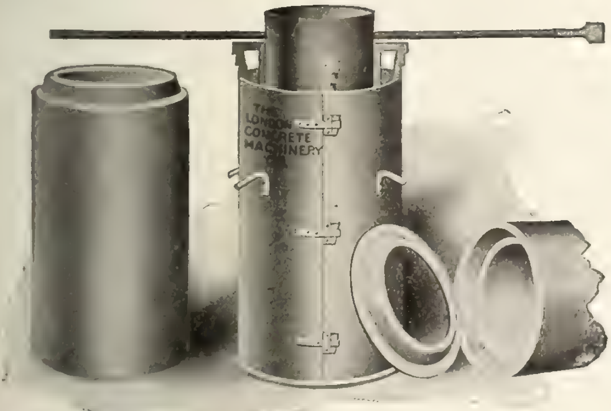

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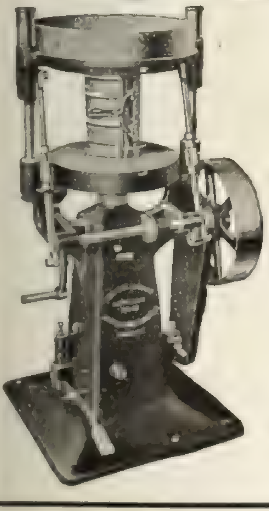

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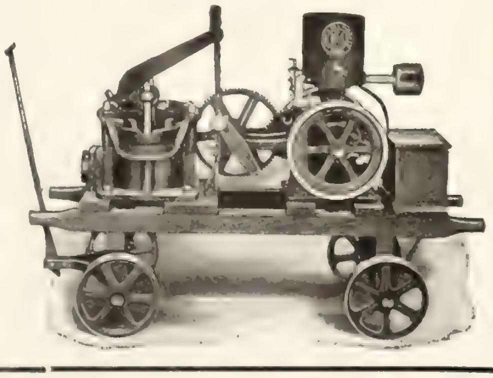

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- Canadian Blower and Forge Co.
- Can. Fairbanks-Morse Company
- Hopkins & Co., F. H.
- Inglis Company, John
- Laurie & Lamb
- McDougall Caledonian Iron Wks

Engineers (Civil and Mechanical)
- Bowman & Connor
- Cape Company, E. G. M.
- Chipman & Power
- Dominion Engineering & Inspection Company
- Farmer, John T.
- Galt Engineering Co., John
- R. S. & W. S. Lea.
- McDougall, Geo. K.
- Pullar, H. B.

Expanded Metal
- Pedlar People Limited
- Trussed Concrete Steel Co.

Fans
- Sheldons Limited
- Sturtevant Co. of Can., Ltd., B. F

Fire Hose
- Can. Consolidated Rubber Co.

Filters
- American Water Softener Co.

Filtration Plants
- verMehr Engineering Co., John

Fire Brick
- Smyth & Ryan

Fireproof Doors and Windows
- Hope & Sons, Henry
- Ormsby Company, A. B.
- Pedlar People Limited
- Steel & Radiation Limited
- Trussed Concrete Steel Co.

(Continued on page 12)

Competing With Your Competitors

"When I see a competitor's smoke ahead of me, I don't sit down and let it choke me. I hustle a little nearer and analyze it. I want to see what its elements are. I want to buy the same kind of fuel myself."

That's what a man told us last week. We had solicited his firm faithfully and regularly for some months. They gave us very little encouragement,—when— in came the order.

Out of curiosity to find out just what arguments had been succesful in finally getting the business, one of the owners was approached. "Arguments nothing," he said. "When I woke up to the fact that MacLean Reports were giving information to my competitors every day that I could not hope to get through my own connection, I woke up, and that is why you got the business."

"I didn't fully realize what a slipshod, haphazard, intuitive way most business men have of keeping in touch with what business is offering until one of my salesmen, Jenkins,—you know him—told me why he had fallen down on the McCormack contract. The only excuse he had was, 'If I had only known of that job in time I would have had a good chance for it. Benson got it, had all the details three months ago—takes MacLean Reports.' That's what decided me. I made up my mind to PROVIDE AGAINST SIMILAR DISASTROUS EXPERIENCES IN FUTURE."

This man is now using MacLean Reports and arming his salesmen with real, live prospects every day,—cutting out all useless footwork and eliminating tedious waits in outside offices. And the beauty of it is his expenses are actually lower and he is getting more business than ever.

The decision this man made when subscribing to MacLean Reports interests you **because his problems are similar to yours.** You both want information that you can use to get business. You want to know how you can get it more quickly, get it better, easier and at a lower cost. You may investigate our proposition entirely at our expense. No obligation, no outlay on your part. Merely fill in and mail the Inquiry Coupon. It will bring you sample reports and complete details of our service and how it will help you better your business. Mail the coupon TO-DAY.

MacLean Daily Reports
Limited
25 Charlotte St.
Toronto, Can.

Your Coupon For Samples

MacLEAN DAILY REPORTS, Limited,
25 Charlotte Street, Toronto

Gentlemen,—

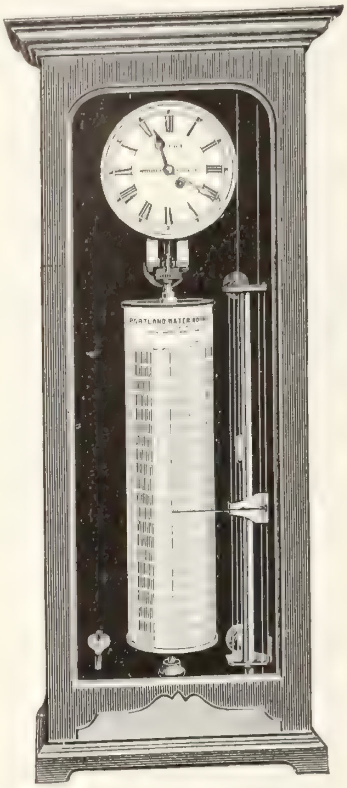
Please send me without obligation on my part, the folder and sample reports referred to in this advertisement. Quote rates for the territory checked (X)

B.C. Alta. Sask. Man. Ont.
Que Maritime Toronto Montreal

Name ....

Address ....

Attach this Coupon to your business letterhead



The rise and fall of water in a Reservoir, Tank or Well can be accurately recorded in the Engineers Office, even if it is fifty miles away. The Transmitter will show locally the variation, and will send impulses to the Recorder for every inch rise and fall. The Recorder will show all this on the chart and the pen acts as a graphic indicator, and enables the level of the water to be seen at a glance.

The complete outfit, without batteries or line wires, with one year's supply of charts delivered free, duty paid any town in Canada

$350.00

Gent & Co., Ltd.

Leicester, Eng.

Cables, Lodestone

KERR

Gate Valves
and
Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

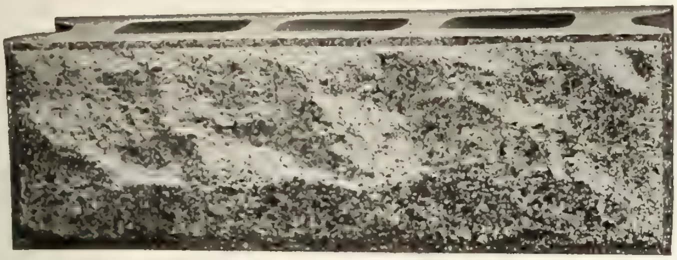
that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited

WALKERVILLE, ONTARIO



8 x 8 x 24 inch Granite Rock Face Block

Molds for Casting
Waterproof Hollow Cement Building Blocks
With Granite Faces

THEY COST LESS — THEY SELL FOR MORE
YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.

8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited **(Zagelmeyer System)**
298 Howard Avenue, WINDSOR, ONTARIO

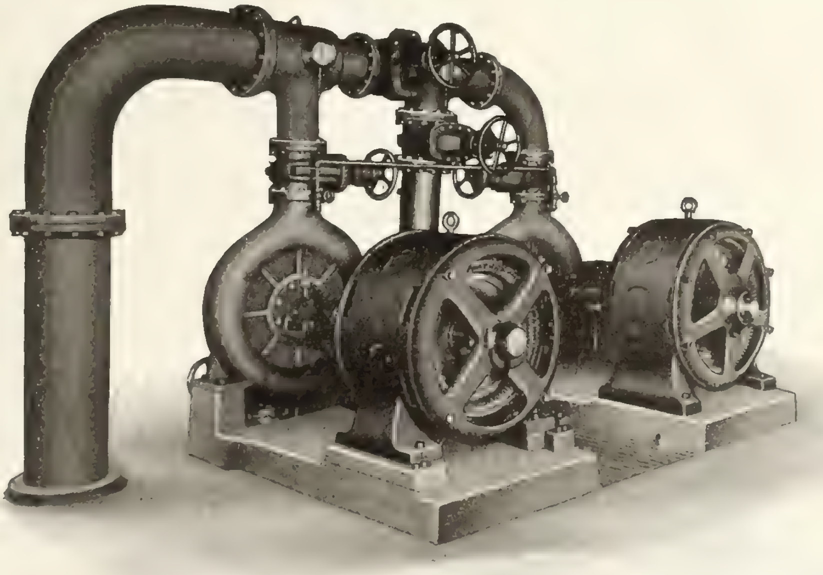
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Manufacturers of

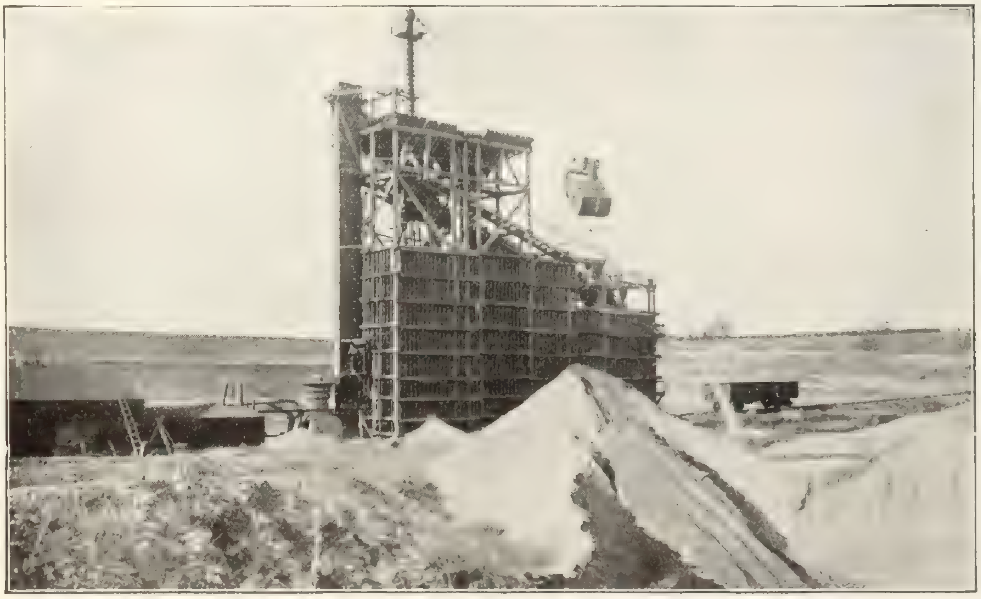
Iron Fire Escapes

Marquise, Covered Ways,
Balconies, Gates and
Railings, Collapsible Gates
and
Fire Door Fittings

Aikenhead Architectural Metal Works

364-370 Richmond St. W.,
TORONTO, ONT.

"Dull" Sand and Gravel Plants



We are prepared to design and furnish complete plants for handling, washing and storing sand and gravel—special plants for special conditions. The illustration shows a Dull plant with sand and gravel being excavated and conveyed to plant by a Dull drag line excavator. Dull improved conical screens are arranged to make two sizes of sand and two of gravel.

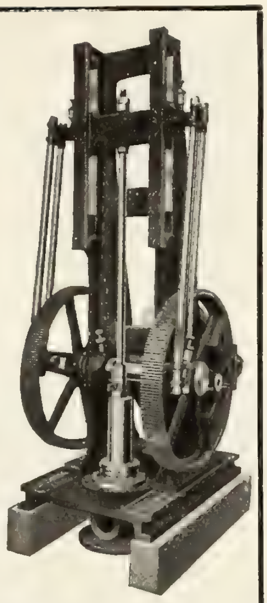
Write us for our illustrated catalogue.

The **Raymond W. Dull Co.,** 111 Washington St., **Chicago**

Western Sales Agents Bentz-Richardson Co., WINNIPEG Mills Bros., 215 Ryrie Bldg., TORONTO

Water Supply from Deep Wells

is obtained at a minimum cost by use of our deep well pumps.



Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer.

A. D. COOK

Lawrenceburg, Indiana, U. S. A.

Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS,** Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

CATALOGUE MAILED UPON REQUEST

DUMB WAITERS

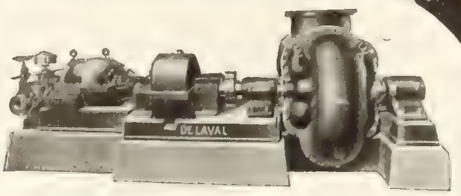
Roelofson self retaining dumb waiters are fast replacing the old styles.

They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of costs for special machines to be used as wall hoists, freight or invalid elevators.

Roelofson Elevator Works

Galt, Ont



De Laval Multi-stage Geared Turbine driving single-stage pump; 30,000,000 gallons per day capacity against 90 ft. head. Compact unit to accommodate limited space in municipal pumping plant.

Turbine Gear and Pump Designed and Built in one shop

The economic superiority, for heavy pumping service, of the centrifugal pump when driven by a steam turbine through the medium of a speed reducing gear is demonstrated by De Laval pumping units for capacities as high as 100,000,000 gallons per day and for heads as high as 340 ft. installed by the cities of Pittsburgh, Philadelphia, Cleveland, Toronto, Omaha, Lynn, and by numerous private companies.

Each of these units consists of a high efficiency De Laval steam turbine, driving a De Laval centrifugal pump through a De Laval double-helical speed reducing gear, all designed and built to work together as a unit by an organization which has been engaged in the production of turbines, speed-reducing gears and pumps for nearly 20 years. The success of De Laval units should not lead to the expectation that a turbine can be picked up here, a gear there and a pump somewhere else, and a satisfactory running pumping unit thus produced. Thorough engineering knowledge and experience with the whole problem is required, and the apparatus to give satisfaction must be accurately and carefully built without division of responsibility.

The De Laval shops produce only high grade apparatus built on a limit gage basis and on a large scale. Each unit, before leaving the shop, is thoroughly tested for both capacity and efficiency.

Write for Catalogue "B-66"

De Laval Steam Turbine Company

Turbine Equipment Co., Limited
Canadian Pacific Bldg., TORONTO, Can.

The E. Laurie Co.
243 Bleury Street, MONTREAL, Que.

No. 176

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Luxfer Prism Company
Pilkington Bros.
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Dull Company, Raymond W.

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Browning Company
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Gillis & Geoghegan
Goold, Shapley & Muir Co.
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Marsh & Henthorn
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Pollard Mfg. Company
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Hopkins & Co., F. H.
Marsh & Henthorn, Limited

Hydrants
Canada Iron Corporation
Gartshore-Thompson Pipe Co.
Kerr Engine Company

Incinerators
Ideal Incinerator & Contracting Company, Limited
Toronto Furnace & Crematory Co.

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Can. H. W. Johns-Manville Co., Limited.
Standard Underground Cable Co. of Canada, Limited

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Hopkins & Co., F. H.
Bechtel, B. E.

Interior Finish and Doors
Canadian Office & School Fur. Co.

Jib Cranes (all kinds)
Morris Crane & Hoist Co., Herbert

Kilns
Canadian Blower and Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.

Kyanized Spruce
Berlin Mills Company

Lath Board
Bishopric Wall Board Co.

Lime
Dominion Lime Company
Standard White Lime Co.

Lighting and Pumping Installations
Can. H. W. Johns-Manville Co., Limited

Locomotives
Canadian Equipment Company
Montreal Locomotive Works

Marble Working Machinery
Pollard Mfg. Company

Metal Lath
Metallic Roofing Company
Noble, C. W.
Pedlar People Limited
Steel & Radiation Ltd.
Trussed Concrete Steel Co.

Metallic Roofing
Pedlar People Limited

Mechanical Draft Apparatus
Sturtevant Co. of Can. Ltd., B. F.

Meters, Water
McDougall Caledonian Iron Wks.
Neptune Meter Co.

Moulds for Cement Blocks
Cast Stone Block & Machine Co.

Oil Pumps
Wayne Oil Tank & Pump Co.

Oil Tanks
Wayne Oil, Tank & Pump Co

Ornamental Moulds
London Concrete Machinery Co.

Overhead Runways
Morris Crane & Hoist Co., Herbert

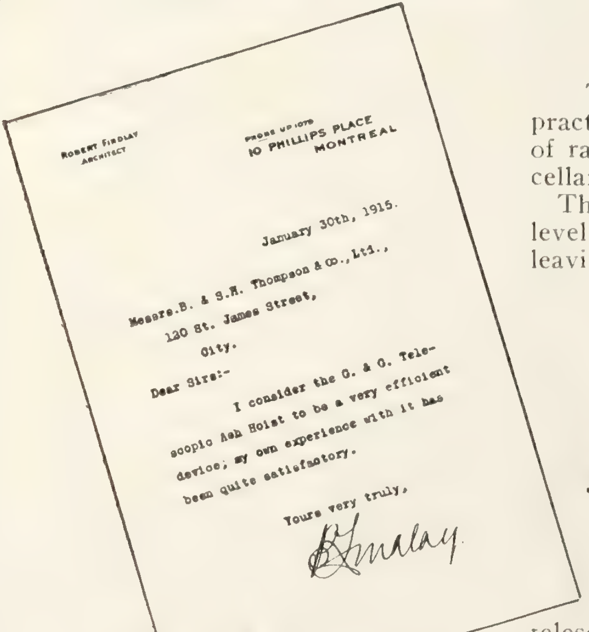
Packing
Can. Consolidated Rubber Co.

Paints and Varnishes
Dominion Paint Works
Hopkins & Co., F. H.

Paving and Paving Materials
Asphalt & Supply Company
Barber Asphalt Paving Co.
Dunn Wire-Cut-Lug Brick Co.
National Paving Brick Manufacturers' Association
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.

Pipe (Concrete, Iron and Wood)
Dominion Concrete Co.
Gartshore-Thomson Pipe Co.
National Iron Works
Pacific Coast Pipe Co.
United States Cast Iron Pipe Co.
Vancouver Wood Pipe & Tank Company
Warren Foundry & Machine Co.

(Continued on Page 14)



ROBERT FINDLAY
ARCHITECT

PHONE UP 1070
10 PHILLIPS PLACE
MONTREAL

January 30th, 1915.

Messrs.B. & S.H. Thompson & Co., Ltd.,
120 St. James Street,
City.

Dear Sirs:-

I consider the G. & G. Telescopic Ash Hoist to be a very efficient device; my own experience with it has been quite satisfactory.

Yours very truly,
R Findlay

[illegible]

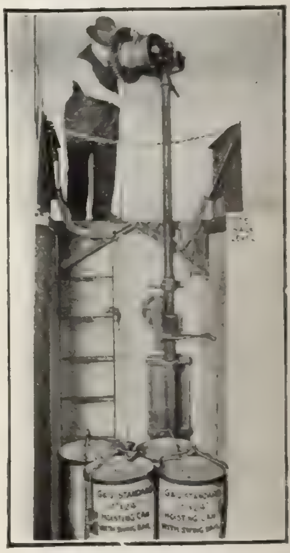
Robert Findlay, Arch.

A "One-Man" Ash Hoist

The G & G Telescopic Hoist is so designed that it is practical for one man unaided to perform the entire operation of raising ash cans to sidewalk and lowering empty cans to cellar.

The operator standing at sidewalk level can raise 4 or 5 cans without leaving the sidewalk.

The G&G PATENTED Telescopic Hoist
with compound gear and brake attachment



Raises a maximum load of 500 lbs. at a guaranteed speed of 30 feet per minute.

When not in use, hoist telescopes and no part shows above street level. This hoist is fitted with a patented "silencer," making it absolutely noiseless in operation. It can be installed in any building, old or new.

Write to our nearest agent for booklet and prices

"Made in Canada"

GILLIS & GEOGHEGAN, Sherbrooke Que.

Black Building Supply Co., Ltd.
Agents for Ontario
Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

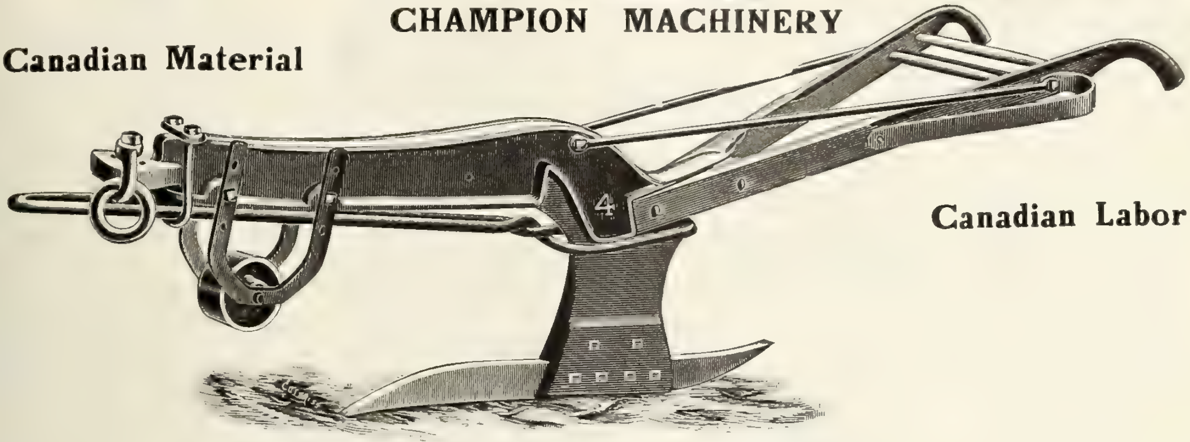
Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

W. T. Grose, Agent for Manitoba, Saskatchewan, Alberta, **Winnipeg**

CHAMPION MACHINERY

Canadian Material

Canadian Labor



Pick and Contractors' Road Plows

Complete line of Road and Street Machinery, Rock Crushers Stone Elevators and Screening Machinery, Portable Engines and Boilers, Road Graders, Road Plows, Road Drags, Drag and Wheeled Scrapers, Street Cleaners, Sprinklers and Sweepers, Street Cleaners' Hand Carts, etc

AMERICAN ROAD MACHINERY COMPANY OF CANADA, LTD., Goderich, Ont.

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Paints (Bridge and Structural Iron and Pipe Coating)
Dominion Paint Works

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Canada Wire & Iron Goods Co.

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Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Marsh & Henthorn, Limited

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Inglis Company, John

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Can. Consolidated Rubber Co.

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Smart Turner Machine Co.
Turbine Equipment Company

Quarry Machinery
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Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Lecky & Collis
George Anderson & Co.
Goodwin, Barsby & Company

Railway Supplies
Can. H. W. Johns-Manville Co., Ltd.
Gartshore, John J.
Hopkins & Co., F. H.

Revolving Stone Screens
Goodwin, Barsby & Company

Road Asphalt
Asphalt & Supply Company

Reinforcements, Concrete & Steel
Burlington Steel Company
Canada Wire & Iron Goods Co.
Dominion Iron & Steel Co.
Pedlar People Limited
Steel & Radiation Ltd.
Trussed Concrete Steel Co.

Road Machinery
American Road Machine Co.
Exeter Mfg. Co., Ltd.
Hopkins & Co., F. H.
Morrison & Co., T. A.

Roof Glazing
Hope & Sons, Henry

Roofing Material
Bird & Son
Bishopric Wall Board Co.
Can. H. W. Johns-Manville Co., Ltd.
Noble, Clarence W.
Paterson Mfg. Co.
Pedlar People Limited

Rubber Covered Rolls
Can. Consolidated Rubber Co.

Rubber Cement
Can. Consolidated Rubber Co.

Rubber Mats
Can. Consolidated Rubber Co.

Sand and Gravel
Rogers Supply Company

Sand Washing Plants
Dull Company, Raymond W.

Safes and Baults
Can. Fairbanks-Morse Company
Taylor, J. & J.

Scales
Can. Fairbanks-Morse Company

Screens
American Road Machine Company of Canada
Canada Wire & Iron Goods Co.
Dull Company, Raymond W.
Goodwin, Barsby & Company

Sewer Pipe
Britnell & Company
Canada Iron Corporation
Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
London Concrete Machinery Co.
National Iron Works
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.

Sheathing Board
Bishopric Wall Board Co.

Shovels (Steam)
Browning Company
Beatty & Sons, M.
Canadian Equipment Company
Hopkins & Co., F. H.
Montreal Locomotive Works

Silo Moulds
London Concrete Machinery Co.

Skylights
Hope & Sons, Henry
Pedlar People Limited

Smoke Stacks
Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
Hamilton Mfg. Co., Wm.
MacKinnon, Holmes & Co.
Manitoba Bridge & Iron Works
Pittsburgh-DesMoines Steel Co.
Pedlar People Limited

ARTIFICIAL MARBLE

Made in Canada

ARTIFICIAL MARBLE is a material manufactured by a new process. The ARTIFICIAL MARBLE is harder than natural marble, is less absorbent and is susceptible to a higher finish. The coloring is non-fading and runs entirely through the marble.

ARTIFICIAL MARBLE is polished (not varnished) in the same manner and with the same material as natural marble.

ARCHITECTS:—Patronize a home industry and specify ARTIFICIAL MARBLE made by a Canadian firm, and with Canadian material.

We manufacture ARTIFICIAL MARBLE in all the beautiful colorings of the Italian, Greek, French and Belgian marbles, and the well known Canadian and American marbles, and our facilities are adequate to turn out the largest contracts.

Specify ARTIFICIAL MARBLE and avoid delays caused by the unsoundness of natural marble quarries.

Manufactured by

J. E. CARREAU

Office and Factory, 13 Notre Dame St., East
Phone Main 5539—Connecting All Departments
MONTREAL

CRUSHED STONE

Good Roads Making Good
by using

Dundas Stone

Best by Test

Canada Crushed Stone Corporation, Limited
DUNDAS, ONTARIO

Toronto Agents:—Rogers Supply Co., Limited, 38 King Street West

SARNIA CORRUGATED IRON

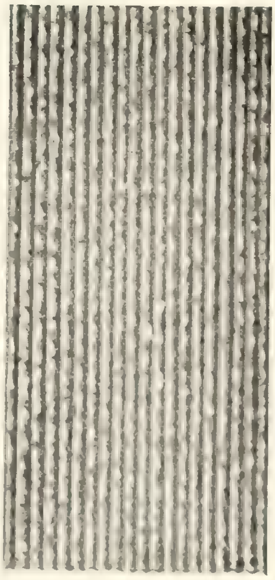
for Roofing and Siding

We know of no other Corrugated Iron in Canada that the manufacturers can give as strong a guarantee as to its lasting qualities, as we can on our Sarnia Corrugated Iron. All our products are made from the Sarnia New Process Galvanized Sheets, which possess remarkable durability when exposed to the weather, and will resist corrosion and the action of the elements to a much greater degree than ordinary steel or iron or those products based on alleged "purity" of the materials.

Standard sizes carried in stock in 24, 32, 36, 48, 60, 72, 84, 96 or 120" long x 33" wide in 18 x 20, 22, 24, 26 and 28" guage.

We also manufacture Plain Galvanized Iron, Metal Sidings, House Shingles, Ventilators, Sky Lights, Eave Trough, Conductor Pipe, Volleys, etc.

We have specially prepared literature on any of the above products, which we will gladly send you on request.



SARNIA METAL PRODUCTS Co., Limited
SARNIA, ONTARIO

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Steam Turbines
McDougall Caledonian Iron Wks.
Sturtevant Co. of Can. Ltd., B. F.

Steel Bars
Burlington Steel Company
Dominion Iron & Steel Co.
Hopkins & Co., F. H.
Steel & Radiation, Ltd.

Steel
Hopkins & Co., F. H.
Lecky & Collis

Steel Pipe
Factory Products Limited
Page-Hersey Iron Tube & Lead Co., Ltd.

Sound Deadening
Can. H. W. Johns-Manville Co., Ltd.

Stair Builders
McGregor & McIntyre

Stair Treads
Can. Consolidated Rubber Co.

Steel Castings
Electric Steel & Metals Co.

Stone Backing
Ceresit Waterproofing Co.

Stone
Britnell & Company
Hagersville Contracting Co.
Maloney, John
Morrison & Co., T. A.
Queenstown Quarry Co.
Rogers Supply Company
Sackville Freestone Company

Stone Saws
Anderson, Geo.

Stone and Sand Elevators
American Road Machinery Co.

Stone Working Machinery
Pollard Mfg. Company

Steel Sash
Hope & Sons, Henry

Structural Iron and Steel
Burlington Steel Company
Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
Dominion Bridge Company
Hamilton Bridge Works Co.
Mackinnon Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
McGregor & McIntyre
Pittsburgh-DesMoines Steel Co.
Reid & Brown
Structural Steel Company
Standard Steel Construction Co.

Submarine Drills
Lecky & Collis

Stucco Board
Bishopric Wall Board Co.

Swinging Gears
Dake Engine Company

Tanks and Stand Pipes
Chicago Bridge & Iron Works
Goold, Shapley & Muir Co.
Hamilton Mfg. Co., Wm.
Inglis, John
Manitoba Bridge & Iron Works
Marsh & Henthorn
McDougall Caledonian Iron Wks.
MacKinnon, Holmes & Co.
Ontario Wind Engine & Pump Company
Pittsburgh-DesMoines Steel Co.
Vancouver Wood Pipe & Tank Company

Telescopic Hoists
Black Building Supply Co.
Gillis & Geoghegan

Tarring Machinery
Taroads Syndicate Ltd.

Terra Cotta
Northwestern Terra Cotta Co.

Testing and Inspecting Bureau
Hunt & Co., Robt. W.

Tile Moulds
London Concrete Machinery Co.

Tiling
Can. Consolidated Rubber Co.

Tires (Auto, Bicycle, Motor-cycle, Carriage)
Can. Consolidated Rubber Co.

Toncan Metal
Stark Rolling Mills Co.

Towers
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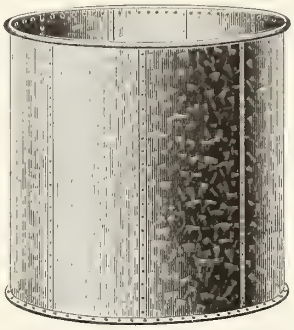

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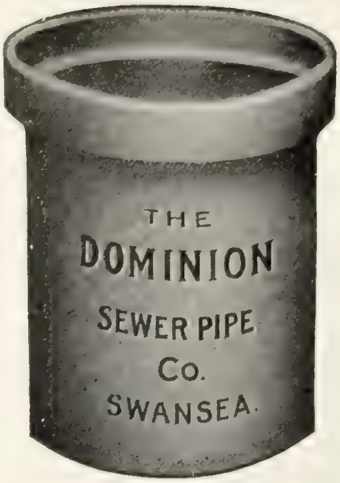

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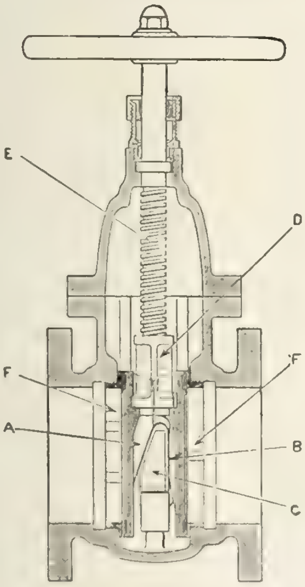

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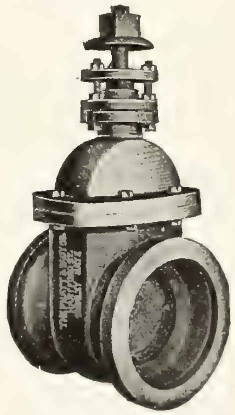

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Business Opportunities

An optimistic note has been struck by a report issued recently by the Canadian Northern Railway. In an effort to discover the actual status of trade in Canada, the company sought the opinions of more than two thousand representative men in all classes of enterprise throughout the country. On the whole, the reports indicate that the period of greatest depression has actually passed: less than ten per cent. of those who have contributed their views to this survey of trade conditions confess to a gloomy outlook. With regard to the probable state of trade after the restoration of peace, the general idea seems to be that conditions will return rapidly to the normal.

Taking the Dominion as a whole, business is shown to be from fifteen to twenty per cent. below the average of last year. Trade in the Maritime Provinces is affected less; while in the West it is far below normal. In Quebec and Ontario business is slow, but shows signs of improvement. The agricultural districts appear to be holding their own: collections in such centres are as good as usual, and activities have not been curtailed to any extent. The chief falling off of trade has been in the large industrial centres.

There is evidence of a disposition to rely upon the crops of 1915, and to qualify expressions of optimism with the remark that the crops will be the determining factor. From late reports dealing directly with crop conditions it seems pretty certain that if the determination of the state of Canada's trade remains with the grain crops there is little cause for anxiety. With the incentive of prevailing high prices the farmers have devoted more time and care to cutlivation; they have used better seed, and have increased their acreage of wheat, and Canada's grain crop for 1915 will show the usual annual increase.

The collapse of the building trades has been the cause of a substantial reduction in the volume of sales of Canadian lumber; but the export trade in lumber has stood up well, and the chief difficulty seems to be in connection with the availability of ships to carry lumber cargoes.

Contracts for military supplies are keeping a large number of machine shops working which otherwise would be practically idle, but the effects are not felt fully yet. The output of shells is but ten thousand a day. The orders for these have been distributed throughout the Dominion, and their influence should be spread pretty evenly.

The leather goods industries are in an abnormally flourishing state. There is a great demand for leather manufactures for the armies of the Allies. Prices have advanced considerably in all lines, the increase being due to the scarcity of raw materials caused by the demands of the military upon the available supplies. A large section of the textile industry is also affected by the military orders, but where these orders are not in evidence trade is somewhat less in volume than it was a year ago. Supplies of raw material from Great Britain have become difficult to secure, even at advanced prices, and it is expected that a scarcity will prevail for the remainder of the year.

The publication of this report has done much to give a better understanding of the effect of the war on Canadian trade. Many people's outlook on the state of trade generally is restricted by the extent to which their own particular line of business has suffered. This is natural, perhaps; but just now the man who has been hard hit by the war, if he be wise, will take a broader view of the situation and recognize the advantages to be gained by turning his energies to other lines of business created by the same war. Many factories now running day and night would be at a standstill if their owners had waited supinely until things picked up in their own line. Instead, by adapting themselves to the changed conditions, they are reaping a rich harvest. Canada has often been called the land of opportunity, and this definition is still appropriate.

Considering the widely-distributed sources of the information contained in this report, it is evident that, while trade is below the normal, it has begun to improve. Taking into account the remarks of many of those who contributed to the report regarding the dependence of trade generally on the 1915 wheat crop, and the reports bearing directly on this crop, it can be seen that there is every reason to expect a decided revival by next year; and if by good fortune the European war should end this year Canada's trade will receive such an impetus as will ensure her a prosperity exceeding even that of her previous banner years.

Our Trade with South Africa

MR. W. J. Egan, the Canadian Trade Commissioner for South Africa, has written an excellent report on South African trade for 1914, having special reference to Canadian imports into South Africa and to opportunities for increasing business between the two countries. South Africa naturally has felt the effects of the European war, and of the disturbances resulting from the incursion of German troops from Damaraland. It is satisfactory to note, however, that Canada heads the list of the three countries which increased their imports into South Africa in 1914, our gain having been $500,000 on a total of $4,840,405. But the Dominion's trade with South Africa is still relatively small, and Mr. Egan points out various directions in which we might increase it. During the last year twenty Canadian firms have established their agents in South Africa, and according to reports good results have been secured on several lines, and all speak hopefully of the future.

Another encouraging sign for future Canadian trade is in the prospect of establishing Canadian commission houses to deal with our exports to this market. Properly organized, such houses would be of great value in increasing our export trade. Many indents for Canadian goods, for one reason or another, are not secured in Canada. There are possibilities also in the establishment of a branch agency or clearing house of some kind in England to look after and quote on many indents which are despatched to the British houses for execution. This is now, and will be for some time, a special feature of South African orders.

With regard to constructional materials Canada makes a poor showing. A glance at the tables in the report shows that the Dominion lags behind in articles by which it should be fairly well represented, especially as we have the benefit of a preferential tariff. The shutting off of European supplies opens the door to Canadian producers, who, we are glad to say, are making greater efforts to introduce their goods into South Africa. We have the advantage of a direct line of steamships, although at the present time these are unable to accept all the cargo offering. The principal obstacle to Canada's permanent increase in trade is the lack of return cargo, as South Africa is primarily an importing country, and exports little of any value to Canada. At the same time there is no reason why we should not do more than we have done—notably in the way of railway material (we are now sending a large quantity of rails), iron and steel, electrical machinery, pumps, engines, paints, varnishes, pipes and fittings. Mr. Egan lays great stress on Canadian firms being represented in South Africa as the only means of securing trade, and states that Johannesburg is the proper location for an agency, particularly for iron and steel and machinery. As an example of what can be done in this way, the imports of calcium carbide are quoted. Representation in South Africa has been the means of steadily building up this export from Canada, and it has been useful in securing extra trade under present conditions.

Although the general imports of lumber decreased, except in the case of oak and poplar, the imports from Canada increased. This is a most opportune time for Canada to increase her exports of poplar, cedar, and pine in the rough, and also of flooring and ceiling. The South African Railways Department are considering the possibilities of securing supplies of ties from British Columbia, while one fairly large order has already been placed in Canada for aspen logs for match making. In manufactured wood the imports from Canada have improved in handles, but the supply should be much larger. Sweden has controlled the trade in box shooks for a number of years, but conditions now are favorable for Canada to secure a larger share of these imports.

Colloids in Road Construction

IN a paper in the May number of the Technology Monthly, Clifford Richardson discusses the relation of colloids to and their effect upon the construction of bituminous roads and asphalt pavements and even water-bound macadam. A colloid is a state of matter, and any kind of matter can be brought into this state. He defines this state as one characterized by a very high degree of dispersion. If a solid, the main characteristic is a subdivision into particles not more than .0001 mm. in diameter and in some cases even .000,006 mm. As the surface area of even the largest of these is 100,000 times as great as that of a cube one cm. on a side which contains the same amount of matter, there is thereby developed great surface energy and capacity for selective absorption.

In studying native bitumens, including petroleum, it is found that some of these form colloidal solutions while others (paraffine scale, for example) do not; he has found, for instance, that Trinidad asphalt contains a considerable amount of clay in the disperse solid colloid form. This offers a method of differentiating the native bitumens or petroleums into two classes, and different oils can be characterized and differentiated by the relative amount of colloidal and diffusable matter which they contain. This characteristic can, Mr. Richardson believes, be developed into a means of differentiating the various bitumens which are used in pavement construction.

The presence of disperse solid colloid particles, with their great surface energy, adds greatly to the cementing or binding characteristic of a bitumen, he states; and he attributes the hard crust of a water-bound macadam to the formation of colloids by the action of water on the fine material, and the cementing of a sand-clay road to the colloids present in the clay.

Tail-Tunnel Regulation in Hydro-Electric Work

By R. D. Johnson*

By applying the principles of the differential surge tank to the regulation of the flow of water in long tail-tunnels running under pressure possibilities which have hitherto seemed unattractive in the design of hydro-electric plans are opened up. The type of construction in which the tail-tunnel flows partly full, reproducing conditions in an old-fashioned tailrace, is necessarily wasteful, and for this reason the writer devised a remedy two or three years ago, but has neglected to publish the fact until now.

The present orthodox type of water power development is arranged to lead the water in artificial channels, pipes or tunnels, at high level, or under high pressure, from one point of a river to another of lower elevation, terminating in a water-driven unit at the power station. In most cases this plan of procedure, making the waterwheel the last link in the chain, is probably the best to adopt, but in some cases there are advantages in an opposite course, which it is the writer's present purpose to indicate.

The idea of dropping the water first through penstocks directly to the water turbine, thence leading it away through a long tail-tunnel, is not new, as there are several plants of this type in the country—notably that of the Niagara Falls Power Company, at Niagara Falls—but in such plants the tail-tunnel is not an integral part of the water system in the sense of an unbroken column from head-water to tail-water, as is the case with the reverse course as commonly adopted. Here there is a definite break in the continuity of flow at the end of a short draft-tube, where the water leaves it and takes up its new course under atmospheric pressure in a partly filled tunnel. In other words, such a tail-tunnel is really little different from an old-fashioned open tail-race. This type of construction is necessarily wasteful.

The reason that it is ordinarily out of the question to permit the tail-tunnel to run full is that such a course would virtually increase the length of the draft-tube to equal that of the tunnel, perhaps a mile or two, and all water-power men are aware of the difficulties arising from an extension of the draft-tube even a moderate distance beyond the unavoidable length.

When the tail-tunnel runs as an unbroken extension of the draft-tube the inertia of the whole water column reacts directly upon the turbine and precludes the smallest sudden change in the gate opening, or at least causes it to be attended by excessive pressure changes, which not only prevent an approach to proper speed regulation, as the load varies, but which endanger the safety of the plant. The recoil of such a column of water following the sudden shutting off of the water at the wheel would be very likely to shut down the plant for extensive repairs.

That it becomes feasible to operate successfully these long draft-tunnels by the use of a small differential regulator connected to the tunnel at the end of the draft-tube proper is easily demonstrable, and needs only to be stated to one who has taken the trouble to familiarize himself with the "differential principle" as described in the October, 1914, "Proceedings" of the American Society of Civil Engineers.

It is not necessary to go into the theory of this recent application of this device, because its function is almost identical with that of the differential surge tank, as applied to the regulation of a long pressure, up-stream from the waterwheel. There is, however, one important difference—the latter must be amply proportioned to take care of the energized water in the system following a complete shut-down of the plant, while running at maximum load, whereas the tail-tunnel regulator needs no provision for such a contingency, because a complete rejection of the water by the wheel gates merely permits the energized column to go on discharging as before, and possibly to draw in some air through the regulator if its supply of water has been previously exhausted. Thus it becomes apparent that a minimum size of tank is sufficient, having capacity for normal regulation requirements, and this usually necessitates a small enough diameter, especially for very long tail-tunnels, so that the extra rock excavation involved in connection with the wheel pit itself is not a particularly important item.

A moment's consideration will impress upon the mind the economical necessity of having continuity of flow wherever long tail-tunnels themselves are required, for if the tunnel is limited to run partly full, not only must its cross-section and grade be ample to prevent filling, but its mouth must be placed at the entreme high-water mark of the river. The high-water stage may seldom occur, and therefore the head represented by the fluctuation of the river level is almost continuously wasted. In some rivers this would amount to a large sacrifice of energy, not infrequently a substantial proportion of the total head. On the other hand, the submerged tail-tunnel may be designed for the maximum economical velocity, however high that may work out to be, just as in the case of a pressure-pipe, giving it the minimum economical cross-section. It may also have its mouth below the lowest water mark, thus utilizing the total available head.

The class of topography which best lends itself to this type of development is where, in a rocky formation, the surface drops off gradually from the intake to the mouth of the tailrace, so that the orthodox development, not finding any high ground above the power house site, would be constrained to carry the water a long distance under a high average pressure. If the head were high, it might well be out of the question to construct a surge tank unless to operate under compressed air, which, although perfectly feasible, and proper when unavoidable, is usually somewhat expensive.

In such a natural location the advantage of the long sealed tail-tunnel is so obvious that it is scarcely worth while to dwell upon it; but it may be well to call attention to the fact that not only is it frequently cheaper, but in some cases the other course would not be commercially feasible, or, sometimes, even mechanically possible. There are, however, many instances where the choice is not so readily determinable, and it is desired to point out the main items of advantage of the tail-tunnel type, which are the first to strike the mind. A pipe or conduit under pressure and located upstream from the waterwheel is sometimes more costly, and from its very nature is subject to more concern, both as to construction and maintenance, than a tail-tunnel which is running under very slight pressure, where a leak would do little harm and rupture is impossible.

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*Johnson & Wahlman, hydraulic engineers, New York.

The surge tank terminating a long pressure system is always a great anxiety to the engineer, on account of the possibility of ice troubles and its menacing location right above the power station. The tail-tunnel regulator is free from both these causes for concern, and is, furthermore, decidedly smaller, because it does not have to provide for complete shut-downs, as before pointed out.

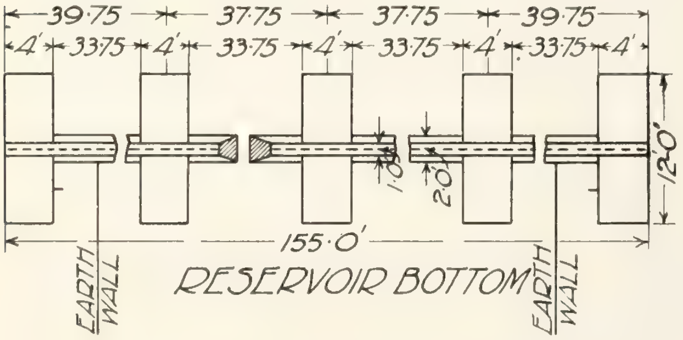
There is no doubt that this type of development has been too long neglected, and the writer believes it will soon have a more prominent place with the engineering profession, because it opens up possibilities which hitherto have not seemed at all attractive under the standard system. That there are many locations where such possibilities exist is a matter of common knowledge to water power men.

The advantage of the "differential principle" in dealing with these problems is, if possible, more marked than in the ordinary case of a pressure pipe, because, not only are all the arguments for it exactly the same, but also there is an added incentive toward economy in size which it favors on account of the rock excavation required to accommodate the regulator.—Engineering Record.

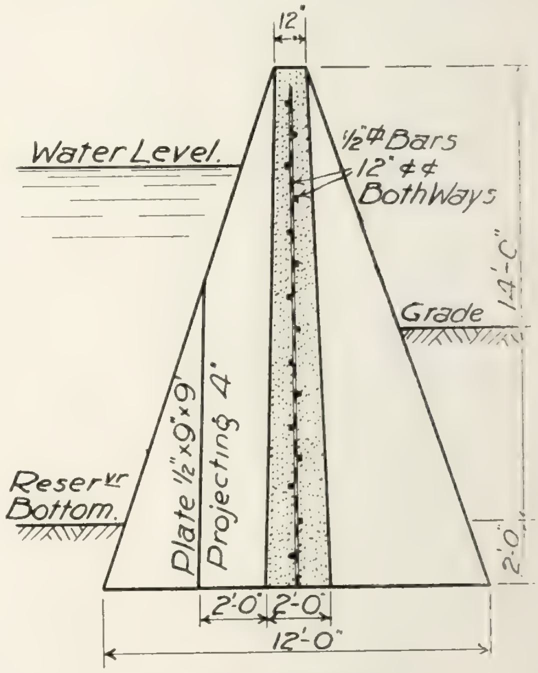
Water Supply for a Small Town

By F. W. Forbes, Little Harbour, N. S.

IN 1912, shortly after its incorporation, the town of Trenton, N. S., faced the problem of a water supply. Different propositions were made by the town of New Glasgow for a supply from their gravity system, but as these stipulated for the amalgamation of the two towns Trenton decided on an independent system. A steep hill within the town limits and overlooking the town proper, which was full of springs, was looked upon as a probable source of supply; so it was decided to tap it, and in the spring of 1912 two bore-holes were put down to a depth of 300 feet. Bedrock was encountered at a depth of 20 feet, and at a depth of 250 feet a stratum of soft rock about two feet in depth was encountered, and at this depth the greatest flow of water was found. The water rose to within 135 feet from the surface, and a cylinder and pump rods were connected up with the walking beam of the drilling machine and a test made of the ten-inch hole. This test was a continuous one of six days' duration, and an average of 208 gallons a minute was obtained. It was at this stage that the writer was called upon to design a system of distribution for the town. Levels were run from the river-bank to the bore-holes at the summit of the hill, which showed an elevation of 284.6 feet. Here it was decided to construct a reservoir, and as the soil overlying the rock was a stiff clay of impervious nature, no better material could be obtained for earthen embankments. These were built with a slope of 1:1 on the inside and 2:1 on the outside. Riprap was placed on the inside slope to protect the embankment from washing down. As the town is a growing one, provision was made for an extension of the reservoir by putting in on one side, instead of an earthen embankment, a concrete wall, the dimensions of which are: length, 155 feet; depth, 18 feet; thickness, 2 feet at the bottom and 1 foot at the top. Five abutments were built in; these were 12 feet across at the base and 4 feet thick, and were carried up to just the thickness of the wall at the top. This wall was reinforced throughout with ½-inch steel rods placed twelve inches apart each way. In this wall is placed a section of 8-inch pipe with a gate valve, and when the growth of the town warrants the expense of an extension another section will be excavated, and the concrete wall between the two will allow of one section at a time being drained off and cleaned.



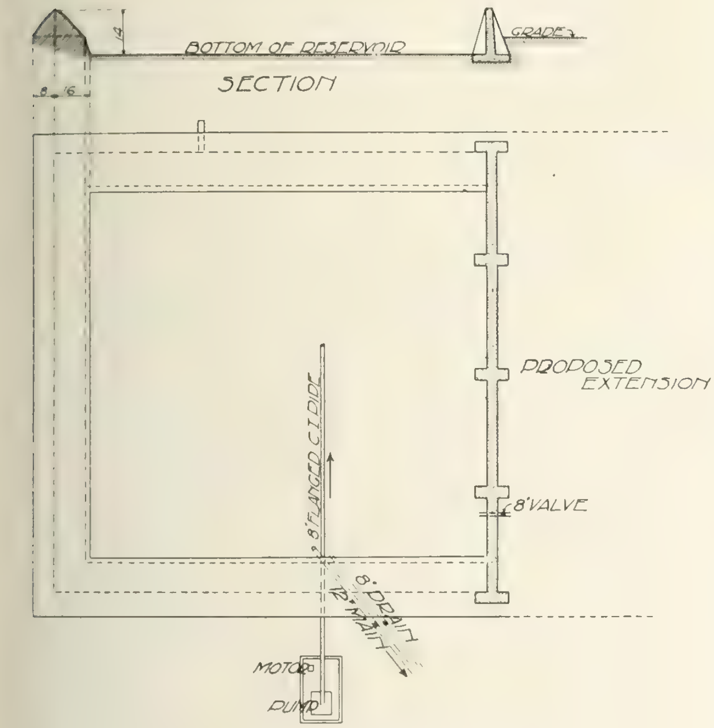
Plan of reservoir wall



Section of reservoir wall

The intake is placed two feet above the bottom of the reservoir, and to this two feet of water a drain has been placed in the bottom which will be connected with the sewerage system of the town and will serve to flush the sewers.

A proper pump was decided on next. The cylinders and rods which were used to test the bore-hole, and which the Town Council had intended to use as a permanent pump, were discarded as being inefficient; and a Deane Triplex pump was purchased. The pump is operated by an electric motor of 20 h.p. There is an automatic starting and stopping device, which is merely a float in a tank connected with the reservoir, and as it rises or falls the switch is thrown out or in. This worked all right, but was found to interfere with operations at the power house of the company supplying power, as at times the pump would start up when the peak load would be on at the power house. Two alarm clocks were then obtained, and so set that at a stated hour the alarm keys of one unwinding would throw in the switch, and the other a few hours later would throw it out. All the attendant has to do is to go up and wind and set the clocks each day.



Details of reservoir, showing proposed extension

I cannot speak too highly of the advantages of the Triplex type of pump, and for the benefit of those who have not seen one perhaps a word of explanation would not be out of place. The cylinder contains three plungers operated by hollow rods working inside of each other and connected to the crank-shaft by cross yokes. The arrangement of the cranks at the crank-shaft is the secret of the success of this type of pump. They are so arranged that just before the first plunger reaches its maximum height the second one begins to take up the load, and so on with the third; so that a constant flow of water is maintained through the discharge pipe, and there is a uniform strain on all parts of the pump-head and rods. I might state in passing that during the contractors' test of one week's duration not a bearing of the machinery became heated, or even warmed.

The pipe-line from the reservoir to the town consists of about 1,500 feet of 12-inch pipe, and branching at right angles each way a 10-inch line is laid. This 10-inch line is across the hill and runs the full length of the town, and from it 6-inch lines will be laid down the various cross streets.

The contract price for the construction of the reservoir was $4,496, which with extras was increased to about $5,000. For trenching, laying and caulking, and backfilling 12-inch pipe-line the cost was 44½ cents a lineal foot, and for the 10-inch line 38½ cents a foot.

I have not the exact figures of the pump and its erection to hand at the present time, but it was in the vicinity of $7,000.

The contractors for all this work were the Doane Engineering Company, of Halifax, who carried it out in a most efficient manner.

Painting Steel to Prevent Electrolysis

REINFORCING steel embedded in concrete which is so located as to be subject to the action of stray electric currents is in danger of being disintegrated by electrolytic action, especially in the presence of moisture. It has been proposed, says Engineering Record, that such steel be given a protective coating of paint as a preventive measure, although the weakness of the bond or adhesion between painted steel and concrete was generally deemed so important an obstacle to this practice as to condemn it entirely. Further, previous tests seem to have shown that common paints are not absolutely impervious to moisture. In an article appearing in that journal more than a year ago E. B. Rosa and B. McCullum discussed the results of tests of over forty common paints, of which not one withstood a potential of 4 volts for any length of time, pitting of the steel occurring within a few months in all cases. They concluded that common paints may even increase the tendency to dangerous electrolytic action because of the concentration of such action in small areas where the paint films break down.

New Tests

New light is now thrown on these questions by an article entitled "Paints to Prevent Electrolysis in Concrete Structures," by Henry A. Gardner, Assistant Director of the Institute of Industrial Research, Washington, D. C. This article, printed in the March issue of the "Journal" of the Franklin Institute, contains a complete discussion of the results of about fifty tests on painted steel rods embedded in 1:2 Portland cement mortar cylinders. Two series of tests were made, differing mainly in the fact that the second series was continued for only 300 hours—240 hours under 30 volts, and 60 hours under 55 volts, with the cylinders always immersed in water up to within 1 in. of the top surface.

The first series of tests was made as follows: At the age of one month the cylinders were all connected up in parallel for 24 hours under 30 volts; then, since the current passing was found to be very small, they were placed in about 2 inches of water for one week. In a few cases it was found that cracks appeared near the bottom where moisture had affected the films of paint. They were then immersed in water up to within 1 inch of the top, and continued under 30 volts for ten days longer.

In all cases the current readings were made daily, and cracking was shown whenever the current was appreciable. The painted rods were given two coats of the paint to be investigated, allowing an interval of one week for drying. Bituminous paints, oil paints, aqueous paints, lacquers, and oils and varnishes were tested. Two specimens contained unpainted rods which showed much earlier cracking and disintegration. It is impossible to give here the results in detail, but in general it was found that bituminous paints, a few oil paints, lacquers and varnishes gave the best results.

Tests of Bonding Strength

In order to determine the effect of paint upon the adhesion between steel and cement mortar a similar set of specimens was tested in a Riehle testing machine. Pressure was applied upon the painted iron rod projecting from the top of the cylinder until the bond was destroyed, and the comparative strength thus determined. Some of the water paints and lacquers showed bonding strength about as high as the plain steel, but failed to act as insulators; while others were good insulators, but low in bonding strength. Most of the oil-pigment paints made with raw linseed oil gave poor or only fair results, while much better results were obtained with boiled linseed oil, which dries to a harder, less porous, and more fully saturated film.

A very effective method for increasing the bond between the painted steel and concrete is to "sand" the painted surface just before it becomes dry. This produces a rough surface, which was found to increase the bonding strength as much as 100 per cent. in one instance, and to give much better insulating values.

Important Results and Electrolytic Action

Wherever there were voids in the surrounding mortar, at or around the painted rods, corrosion was most severe, and pitting was shown. The breaking down of a paint film, probably due to its having been broken through by enclosed hydrogen gas developed by the electrolysis of the water in the damp concrete, was always recorded by a sharp rise in the amount of current passed, and a noticeable fizzing sound. Bubbles of gas which burst with an audible explosion when lighted were brought to the top around the iron electrodes, sometimes carrying soft oily products. Such disintegrating effects of electrolytic hydrogenation might be prevented by thoroughly oxidized coatings, which could be obtained by allowing a period of sixty days for the drying of oil paints before using in the cement.

Paints which form highly impermeable films keep water away from the underlying iron and offer great resistance to the passage of electric currents. Previous investigations made by Mr. Gardner have determined the actual degree of porosity shown by various types of paint films, as reported in Bulletin 18, Scientific Section, Paint Manufacturers' Association of United States. The addition of a pigment to an oil usually increases the resistance to moisture and makes a more impermeable film.

Conclusions

The corrosion of metal embedded in concrete structures, by stray currents of high voltage, is often productive of serious effects. The use of properly-made paints upon such metal constitutes a safeguard that should not be neglected by the engineer. Such paints may be prepared from the following substances.

The vehicle should contain: (1) Boiled or bodied oils or products which dry to a fairly saturated film; (2) oils which dry by semi-polymerization rather than oxidation; (3) oils which dry to a flat rather than a highly glossy surface.

The solid portion should contain a percentage of: (1) Pigments which are coarse and which therefore tend to form films, having a rough surface; (2) pigments which are inert and which do not act as conductors of electricity; (3) pigments which are either basic or of the chromate type.

The painted metal should be "sanded," if possible.

An Efficient Recording Gauge for Weir Measurements

By David E. Adams and Earl I. Roberts*

THE city of Columbus is having made a sewerage survey under the direction of Prof. F. H. Eno, of the Ohio State University, and while employed upon this work as inspectors the writers designed and built the gauge described herewith.

Our original intention was to build a gauge for the measurement of the dry-weather sewage flow only and for use with metal weirs, which had been placed in various sewers of the city, but we are now using these gauges also for the measurement of storm flow, and they are giving excellent service.

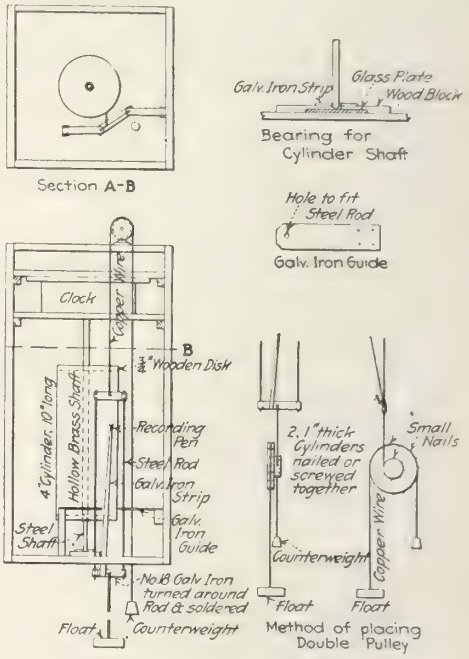


FIG. 1 FIG. 2

Details of recording gauge

The gauge consists of a wooden float covered with galvanized iron, to which is attached a framework of two small steel rods connected by galvanized-iron strips, which carries the recording pen. To the upper end of this framework is attached a cord running over a pulley above and carrying a counterweight. The cylindrical drum carrying the record is covered with thin galvanized iron, and is driven by an eight-day double-spring clock manufactured by Seth Thomas, Thomaston, Conn. The record sheet is fastened on the drum by rubber bands at the top and bottom.

The framework carrying the pen is prevented from moving laterally by means of guide strips, in which holes to fit the steel rods are made, and also by means of the counterweight. The bearing for the drum is made as shown in the drawing by the use of a small glass plate. The shaft carrying the drum is fixed rigidly to the clock, and is geared so as to make one revolution in twelve hours.

The whole apparatus is built in one box, and holes are cut in the top and bottom to allow for the float wire and counterweight cord. In the gauge used by the Massachusetts Department of Health the recording pencil is carried on a rod which in turn is guided in its vertical motion by a small arm moving in a slot. The rod to the float must not be too long, or its weight would prevent the free working of the float; hence, if it were desired to install the gauge in a manhole, say 10 ft. above the level of the sewage, there would probably be come difficulty in its working.

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* Writing in the Engineering News.

As gauges of this type record the actual variation in the flow or head, the cylinder must be of such height as to cover this variation. In order to measure greater variations without the use of a very high cylinder (as during a storm) we have used an auxiliary double-pulley arrangement as shown in Fig. 2. This requires the use of another small counterweight, but it has worked very satisfactorily. By this arrangement the range of the cylinder may be increased according to the ratio of the circumferences of the pulley rings.

The advantages claimed for this gauge are: (1) It is extremely simple and easy to build; (2) by means of adjusting the length of the float wire it may be installed at any height above the flow line; (3) the gauge is covered and thereby protected when placed beneath a perforated manhole cover; (4) its cost is low; (5) it may be installed easily in sewers, sump holes, or open streams.

Modern Garbage Disposal Plant at Berlin, Ont.

A NEW garbage incinerator at Berlin, Ont., was opened officially on May 28th. A number of municipal officials from other cities were present.

The plant illustrates the latest developments in connection with the destruction of garbage. Oil fuel is used to start and generate heat for the destruction of all garbage that will not burn unaided. Two burners are used in the animal chamber, and a separate burner in each of the two garbage chambers. The use of oil greatly facilitates the obtaining of a high degree of heat in a short time. It is understood that the heat of the furnace can be raised to 1,800 deg. Fahr. in thirty minutes. By an interesting arrangement the foul air arising from the garbage on the dumping floor is drawn through a pre-heater by a large fan and used as a force draught to keep up the combustion in the furnace after the oil burners are turned off.

The incinerator is guaranteed to consume fifteen tons of garbage in twenty-four hours. Tests made by the City Engineer show that the plant consumed 31,000 pounds of garbage of all classes in less than eight hours, besides a horse weighing 1,350 pounds.

An important feature of the new plant is the entire absence of odours either inside or outside. When the horse was burned at the opening of the incinerator no smell could be detected from either the charging opening, from the furnace doors or from the exterior smoke stack.

The incinerator is of the single cell furnace type, and one or both cells may be used at a time. The cells are designed so that in case of repairs being necessary to one the other may be kept in full operation while the other is shut down. The animal chamber is placed next to the main combustion chamber and receives the waste heat from the two garbage cells. When an animal is to be destroyed the heat is raised by the use of the oil burners.

All the fire chambers have water-sealed doors which prevent the escape of any of the gases from the combustion of waste and keep cold air from entering the furnaces. The exclusion of draughts of cold air from the furnaces has a material value in preventing sudden contractions which would have a destructive effect on the furnace walls.

Exterior view of plant

The building is entirely fireproof. The dumping floor is constructed of reinforced concrete, while the upper storey is built of steel and corrugated iron. The smoke stack is of brick.

Provision is made for the drying of all wet material amongst the garbage before it is raked over the fire-grate, where all refuse is reduced to ashes and clinker.

A motor-driven suction fan provides air circulation.

Clinkering doors of furnaces and clinker car

Dust pockets and paper screens are provided to prevent any dust or paper blowing up the stack. The second combustion chamber burns all gases arising from the burning in the first chamber.

The incinerator was built by The Ideal Incinerator and Contracting Company, Limited, of Toronto, on their own patented design.

Floating Concrete Caissons in Use

By Harrison S. Taft, assisted by O. D. Jones

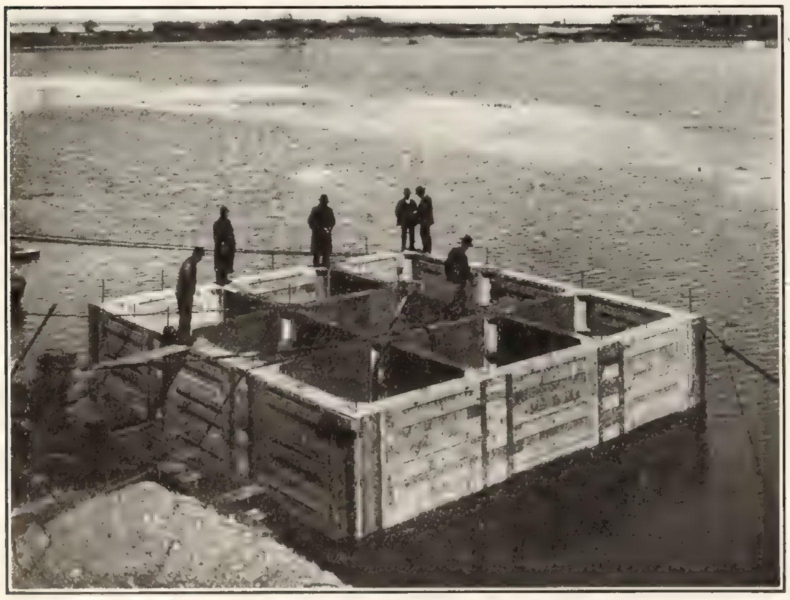
By the kind co-operation of Professional Memoirs, Corps of Engineers, United States Army, Washington, D.C., who lent us the illustrations, besides giving us permission to reprint part of Mr. Taft's article, which appeared in the March-April issue of that paper, we are enabled this week to present a well illustrated description of the use of floating concrete caissons in several marine undertakings in Canada and the United States.

The introduction of floating concrete caissons into Canada seems to have been the results of the work of Mr. Tromanhauser, who, in 1910, developed a type of caissons having a wooden bottom with concrete side and interior walls. While the use of wood may be permissible in fresh and non-teredo infested waters, it would seem that such a use of timber would not work out favorably to such undertakings in teredo infested waters unless the wooden bases were so well sunk into the soil as to preserve them against attack from the worm.

The first work done in Canada with floating concrete caissons by Mr. Tromanhauser was in the building of the foundation wall of a large building at Goderich, Ontario, in 1910. Four wooden caissons 54 feet long, 14 feet wide and 5 feet deep were first constructed and launched. After launching, the concrete side and cross interior walls were started from the floor of the wooden caisson and built up 2 feet at a time to a height of some 20 feet. The interior partitions divided each caisson into six compartments 9 feet by 14 feet each. To insure good work, the fresh concrete was always kept above the water level until hardened. In order to maintain stability, it was necessary to place rock ballast in the compartments of the caissons as the walls were carried up. After the proper height had been reached, the semi-concrete floating structures were towed to their position in the sea wall and sunk by admitting water through valves in the lower part of the structures. After all the caissons had been sunk to place, they were filled with rock ballast and the decking put in place.

Following up his first successful attempt with floating concrete caissons Mr. Tromanhauser made use of the same principle for the foundation of a grain elevator tower at Goderich in 1912. The caisson was 30 feet square by 24 feet deep and contained nine compartments. The outer walls of the caisson were 12 inches thick, the partition walls 10 inches. The same mode of constructing the crib as in the case cited above was used, and the whole structure sunk on to a prepared rock bottom by filling the interior compartments with sand and gravel. Piles were also inserted in the fill so as to transport directly the weight of the tower to the rock bottom. A concrete slab was placed over the top of the filled caisson and the concrete tower erected thereupon.

Completed Tromanhauser pontoon used at Goderich.


Completed crib being sunk on tower site at Goderich.

Goderich Breakwater.—As the direct result of Colonel Judson's success with floating concrete caissons on Lake Michigan, the Canadian Government decided to adopt his system of construction in the building of a long breakwater at Goderich, on Lake Huron, Ontario. This work was started in the fall of 1911 with the building of three concrete floating caissons, each being 100 feet long, 26 feet high, with a width at their base of 35 feet but only 30 feet at their tops, thus giving a tumble-home of 2½ feet on each face. The caissons were divided into twenty-four compartments by means of two longitudinal and seven cross concrete partitions. These three caissons were sunk in the inner harbor at Goderich during the winter of 1911-1912, being refloated in the spring of 1912 and put in their proper place in the breakwater along with three other caissons that were constructed during the spring of 1912, thus making 600 lineal feet of work completed during one summer.

In the construction of the caissons a form of floating scow dry-dock was adopted by the contractors. This dry-dock consisted of a specially constructed scow, 114 feet long, 44 feet wide, with sides 11 feet high, the bottom of the scow being built with special care as regards its use. One end of the scow was so built as to swing outwards and thus permit the concrete caisson to be floated out when built to a proper depth.

The base of the concrete caissons, properly reinforced, was first poured directly upon the deck of the scow. The interior and exterior walls were next brought up 3 feet at a time simultaneously, care being taken to secure a water-tight joint between each pouring by means of grout. By the time the concrete walls of the caisson had reached a height of 14 feet, the top of the sides of the scow dry-dock were almost submerged. By filling the space between the sides of the concrete caisson and the walls of the scow dry-dock with water and by placing heavy weights therein, the scow dry-dock was parted from the base of the caisson and sunk on to the bottom of the harbor. The end gate was then opened and the caisson towed out, floating on its own bottom. The further upbuilding of its walls was then proceeded with as in case of an ordinary wooden caisson. The weights being removed from the sunken scow dry-dock and its gate closed, the structure floated at such a draft as to bring its sides above the water level, which permitted of its being pumped out and another caisson built therein while the first one was being finished in a floating position. Not only was great care taken in the mixing and placing of the concrete, but regular tests were made of the ingredients so as to secure a water-tight structure.

While the caissons were being built the bottom of the lake where the caissons were to rest was brought to a level by dredging and sweeping, the sweep being a reinforced concrete beam, 12 by 12 inches by 40 feet long. Since the outer face wall of the caissons was thicker than the rear wall it was necessary to place ballast in the caissons in such a location as to secure a more uniform draft than would otherwise have existed.

After being towed to position the caissons were sunk into position upon the prepared bed by pumping in water, an operation that took about five and one-half hours, at which time the caissons became safe against any ordinary storm, their tops being but 2 feet above water level. The various compartments were next filled with stone, sand and gravel. A concrete superstructure was then built up on top of the sunken caissons to a height of about 11 feet above lake level, the concrete extending down some 6 feet into the two outer rows of compartments.

During the season of 1913, another 600 feet was added to the breakwater by the same mode of construction as above described, the caissons being 28 feet deep, instead of 26 feet, on account of a greater depth of water. Another 400 feet was added in the season of 1914. The four caissons which formed this addition had been built in the fall of 1913 and sunk in the harbor during the winter, and were refloated and put into position in the breakwater in the spring. The total length of this piece of work is 1,660 feet, the longest individual piece of work of its special mode of construction built in America so far, thus showing the great faith the Canadian Government has in Colonel Judson's system. A heavy riprap fill of triangle shape exists along the outer face of the breakwater to a depth of 14 feet.

The exterior walls of the caissons are 16 inches thick, the inside face walls 14 inches thick, all built without taper. The base is about 24 inches thick, the entire structure being well reinforced and having substantial fillets at intersections of all walls.

Welland Canal.—In the rebuilding of the Welland Canal a very extensive use of floating concrete caissons is being employed, special new features having been worked out to suit local conditions. This undertaking represents the latest development of Mr. Tromanhauser's system, combined with a system of removable wooden bottoms for the caissons as worked out by Mr. J. L. Weller, engineer in charge of the improvements, so as to permit of their repeated use and to allow of the interior fill resting directly upon the soil and not on the wooden bottoms. The caissons being used are 111 feet long, 38 feet wide and 34 feet deep, having eighteen compartments each, weighing about 2,000 tons. When afloat they have a draft of about 16 feet and a freeboard of 18 feet. In order to keep the centre of gravity as low as possible, the walls are made thicker at the bottom of the caisson than at the tops. Even with this precaution, it is said that the centre of gravity of the complete caisson when afloat is near the water line and that they are very sensitive in stability.

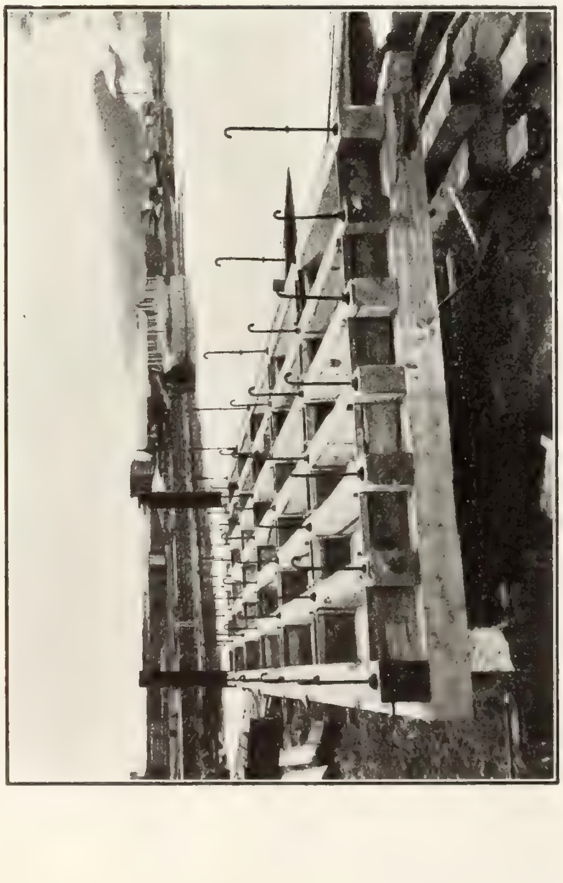
United States

The first application that Colonel Judson seems to have made of his idea of floating concrete caissons was in the construction of Government breakwaters on Lake Michigan in 1908, these undertakings apparently being the first application of floating concrete caissons in the United States, if not in America.

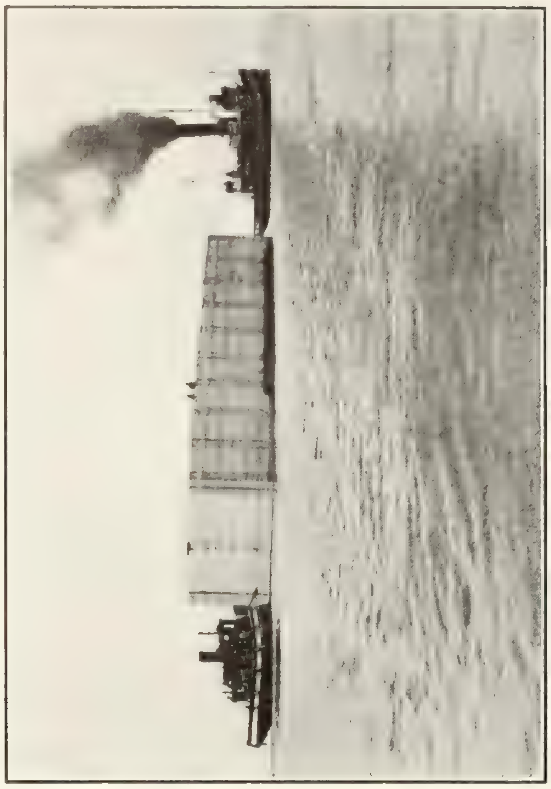
To determine the effects of frost upon the interior fill of a reinforced concrete caisson, a small structure (7 by 6 by 5½ feet, approximately) with walls from 4 inches to 5 inches thick, was constructed by Colonel Judson in 1907, filled with sand and covered over with a concrete slab and allowed to remain in an exposed position all winter. The results of this experiment were such as to justify the use of concrete caissons on a larger scale in the Algoma, Manitowoc and Milwaukee breakwaters, as no damage was done to the experimental caisson on account of frost action.

Algoma.—The twenty caissons used in building the Algoma breakwater were 24 feet long, 15 feet wide, 12 feet 4 inches high, of a rectangular shape, the caisson part of the breakwater being 511 feet long. As the caissons have to withstand a severe wave action due to the 140-mile fetch of the seas, a heavy construction was used, the exterior walls being 12 inches thick, the athwart middle partition 10 inches thick, while the bottoms are 16 inches thick. The middle partition wall divides the caissons into two compartments of about 10½ by 13 feet, a 1:2:4 mixture being used throughout. Each caisson weighed 119 tons, corresponding to a draft of 9.7 feet, giving a freeboard of 2.6 feet when afloat. After launching, the caissons were towed 12 miles through the open water at a speed of 2 miles per hour to their final location, the place of manufacture having been at Kewaunee, 12 miles south of Algoma. After being sunk by water ballast, the interiors of the caissons were filled with broken stone to within 4 feet of their tops and the rest with a lean concrete. A concrete superstructure was erected over the top of the caissons. The caissons rest upon a pile foundation filled in with riprap.

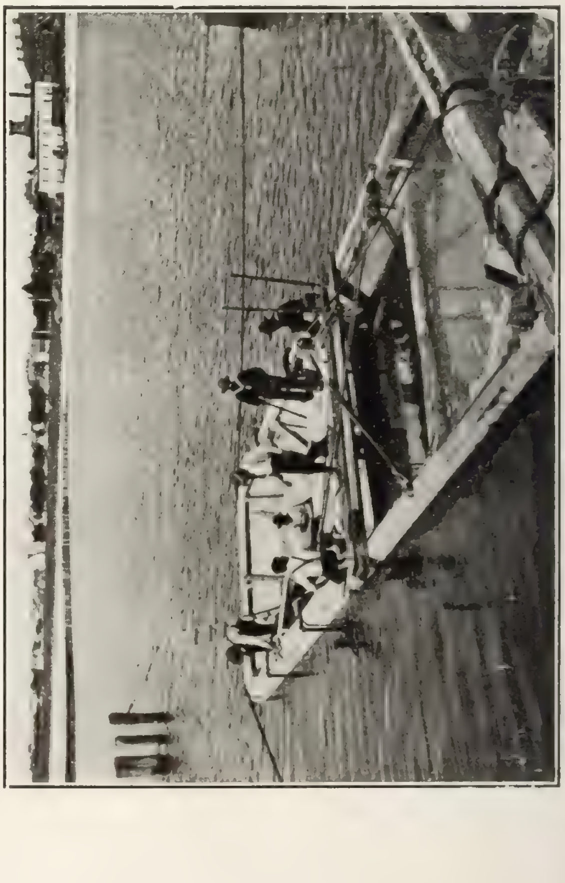
Manitowoc.—The building of the Manitowoc breakwater followed immediately after the Algoma,



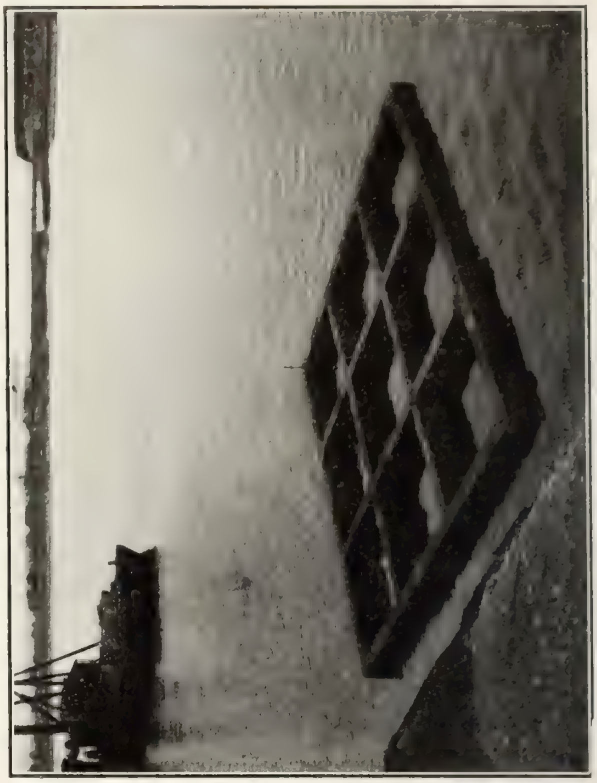
Tromanhauser water-tight pontoon bottom used at Goderich.



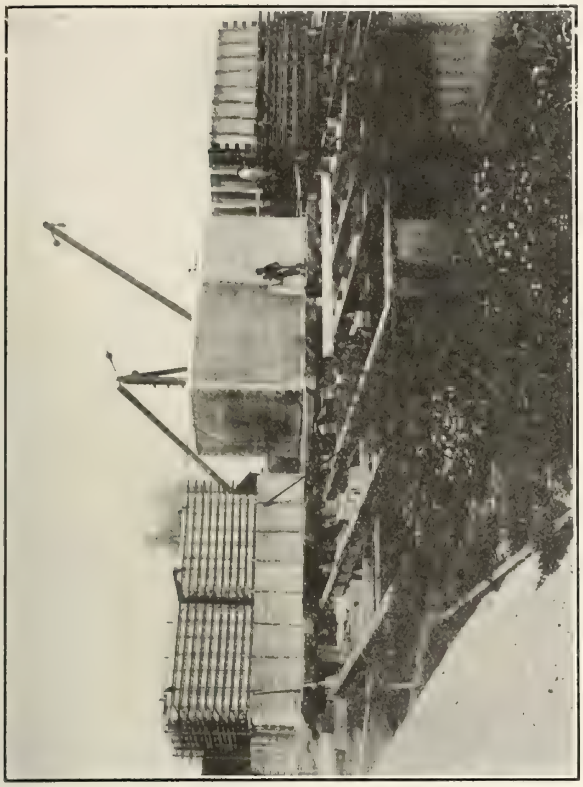
Towing completed caisson to Welland Ship Canal.



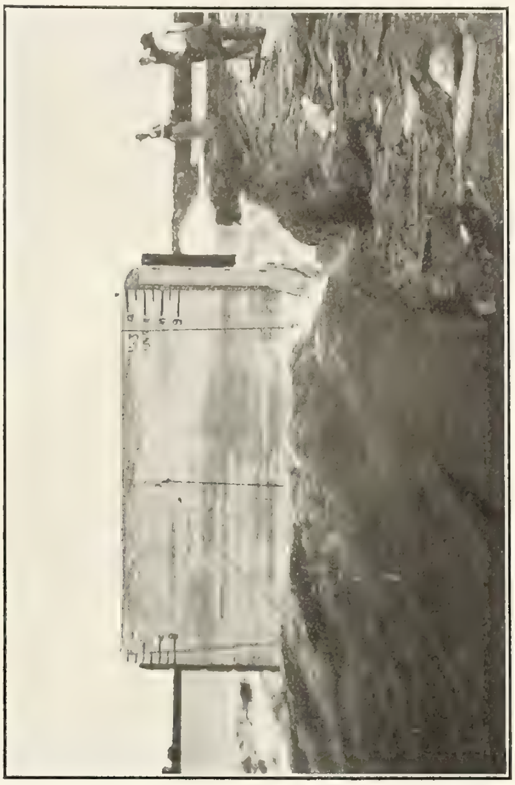
Reinforced concrete caissons being filled and sunk with water through siphons at Algoma Harbour.



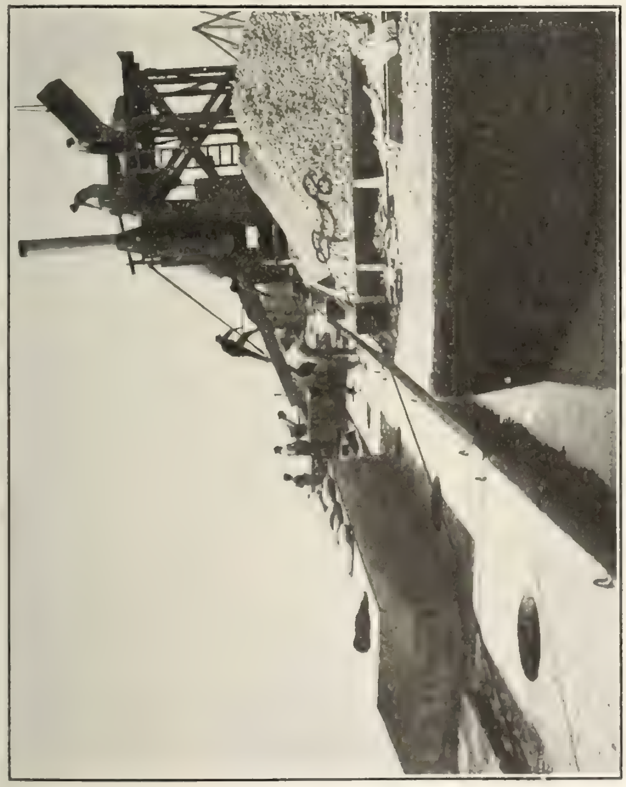
Concrete crib in position on rock bottom in harbour at Goderich.



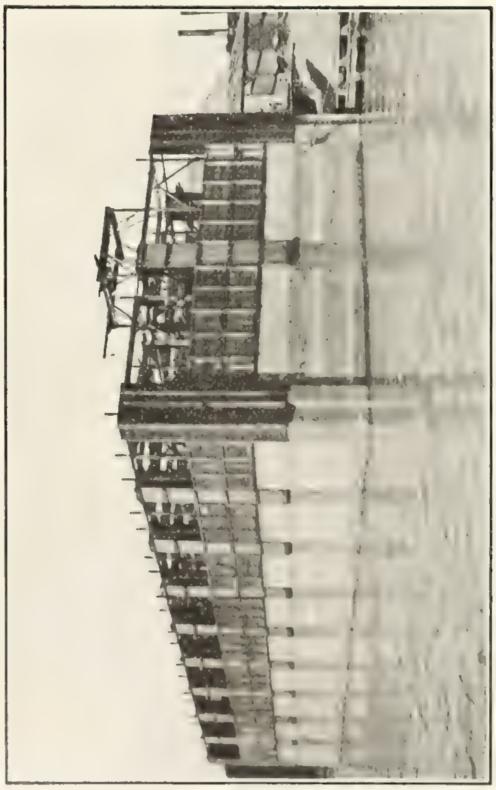
Reinforced concrete caissons under construction on launching ways.



Reinforced concrete caisson being launched at Algoma Harbour.



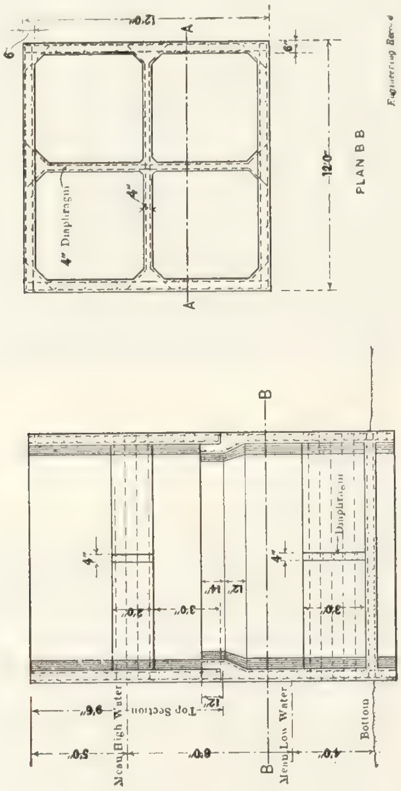
Filling top of breakwater at Algoma Harbour with concrete from mixer.



Concrete crib on the Welland Ship Canal nearing completion.

the same plant, etc., being used to construct the twenty-four concrete caissons needed. Twenty-two of the caissons used at Manitowoc were 24 feet long, 14 feet wide and 11 feet 4 inches high. Their external walls are 10 inches thick, their cross walls 8 inches, the bottom 14 inches. The entire set was launched in the fall and kept afloat all winter, no damage being done to them through stress of weather. The caissons had to be towed 29 miles in the open lake and were sunk into position the next spring following their manufacture. Two additional caissons of a special design were also used in this work, the entire length of the caisson breakwater being 580 feet. The interior of the caissons were filled with rock for the rest of their depth. These caissons rest upon a rubble fill.

Milwaukee.—The next use of concrete caissons by Colonel Judson was at Milwaukee in 1910, the work following the Manitowoc undertaking. In all, fourteen caissons were used at Milwaukee. The outermost four are 54 feet long, 18 feet wide and 15 feet deep. Their exterior walls are 14 inches thick; the two interior partitions 12 inches and their bases 18 inches. The cross walls divided the caissons into three compartments about 16 by 16 feet. Each caisson weighed 352 tons, corresponding to a draft of about 13 feet. The inner caissons were ten in number, each one being 36 feet long, 15 feet wide, 12 feet deep. The walls were 12 inches thick, the interior partitions 10 inches and the base 16 inches. Each caisson had three compartments of about 12 by 13 feet and weighed 175 tons. After being sunk on to a pile foundation they were filled with stone, capped with 4 feet of concrete and now form a pier 576 feet long.



Plan and section of reinforced concrete caisson for Glen Cove pier.

In building the Algoma and Manitowoc caissons, a pile foundation of nine piles properly capped was prepared and covered with 4-inch planks into which were driven 8-inch wire spikes. These spikes projected into the base concrete and thus bound the planks to the caissons, the planks becoming a part of the caisson structure when put afloat. The caissons were built on a level keel and not on an incline, as is the usual practice in ship work. In order to prevent any inflow of the water during launching and towing operations, a water-tight wooden deck was secured to the top of each caisson. After the caissons had been completed their weight was transferred from the pile structure to the launching ways and they were launched overboard.

In a launching operation at Kewaunee three sets of ways were used, each set being 24 feet wide, 103 feet long with a draft of 6 feet at the out-shore end, giving a drop of 3.7 feet. The launching weight of the Algoma caissons was taken as 2.65 tons per square foot. The piles under the launching ways were figured for 15 tons each.

Glen Cove.—The next use of floating concrete caissons in marine work in the United States appears to have been at Glen Cove, Long Island Sound, in the construction of a small wharf for pleasure purposes in the winter of 1909 and 1910; floating caissons were made use of for the piers that support the overhead bridge or runway. Some of the piers were 12 feet by 12 feet in section, others 8 feet by 12 feet. In building the larger size piers, some of which extend 17 feet above the bottom, two caissons were used, one superimposed on the other.

The lower caissons were 9 feet 6 inches in height with a 6-inch bottom of concrete placed at such a height as respects the side walls as to leave a cutting edge, as it were, of 12 inches in depth. The side walls of the caisson were also 6 inches thick. The bottom slab is stiffened by two concrete beams 4 inches wide, 30 inches deep, placed at right angles on the centre lines of the caissons. The upper rim of the caissons was built with an internal offset of about 6 inches, so as to permit the upper section of the completed pier to fit down over the lower section and thus be held rigidly in place. The offset was 12 inches in depth.

The upper caissons were also 9 feet 6 inches in depth, lapping 1 foot on the lower caissons, thus making the total height of the entire concrete pier 18 feet, the cutting edges protruding 1 foot into the bottom. The upper caissons were built without a bottom, but have internal bracing beams or struts 4 inches in width, and 24 inches in depth.

The smaller caissons, 8 by 12, have only one internal partition 4 inches wide, 24 inches deep, with walls 6 inches thick. The walls and bottoms of the caissons were reinforced on both sides, as is necessary in this class of work. Special attention was also given to the cement and its chemical properties. All the caissons were built on shore, put afloat and placed in position by filling the interior with ballast. The upper parts were set in place by mechanical power, as they possessed no floating capacity on account of having no bottoms.

Huntington Bay, N.Y.—During the summer of 1910 recourse was had to a floating concrete caisson in constructing the foundation of a lighthouse built by the Government at the entrance to this harbor. The caisson measured 26 by 30 feet, being 16 feet in height. It was divided into four compartments by means of two interior walls. The exterior walls were 16 inches thick, the interior walls 12 inches thick, heavy fillets being worked at the intersections of the various walls and bottom slab. Both surfaces of the walls of the entire structure were reinforced according to the hydraulic pressure they had to withstand. The vertical bars had the same spacing throughout. A 1:2:4 concrete mix was used.

In the construction of the caisson on the shores of the bay, proper blocking was placed so as to be under the outside walls, as well as under the longitudinal centre line partition. Eight by twelve timbers were then placed upon the blocking in a level position with a 4-inch wooden flooring worked on top. A wooden sub-base was thus formed to the caisson itself. To secure the timber structure to the concrete caisson large lag screws were screwed partly into the 4-inch flooring, 2 feet on centres across the structure, 1 foot on centres longitudinally. The concrete bottom and the walls were then constructed with the proper reinforcement on the timber platform in the usual manner without any interruption in the pouring, thus resulting in a monolithic structure. After the forms had been removed, the exterior walls were given a heavy grout coating.

Owing to the small excess of buoyancy when afloat, the caisson was built in an upright position. After sufficient curing the caisson was launched overboard by means of the usual launching ways and later on towed about ½ mile to its final resting place, where it was sunk on a prepared bottom. Since the completed structure drew 1½ feet more than the depth of water over its final location on the bar, it was necessary to resort to several means to decrease its draft so as to permit of it being properly placed. This was done by pumping air into the pockets formed by the 8 by 12 timbers on the underside of the timber base and partly by bodily raising the structure by a derrick, the caisson then being dragged into position by means of tugs. The four interior pockets were partly filled with water to act as ballast until the placing of the interior concrete fill. Riprap was also placed around the outside of the caisson immediately after setting to protect it against storms. Afterwards the interior pockets were filled with a 1:3:6 concrete placed in the dry, the work being carried on in two pockets simultaneously and alternately to a depth of 5 feet at a lift. The concrete superstructure of suitable design was then erected. The weight of the caisson was about 315 tons, 290 tons being of concrete, and 25 tons of steel reinforcement.

General Considerations.—Before concluding this article it is fitting to point out a few facts as recommended by those best experienced in the use of concrete floating caissons.

Since the caissons are apt to plunge low in launching unless long and expensive ways are used, the maximum stresses are usually experienced during launching and can be so considered in designing the structure.

While it is possible to launch concrete caissons ten days after the manufacture in fresh water work, it is perhaps better to wait a much longer period when the caissons are to be subjected to sea water action, to ensure their absolute permanency.

Concrete caissons possess great stiffness and substantial strength, which permits of their being towed long distances in rough water without danger.

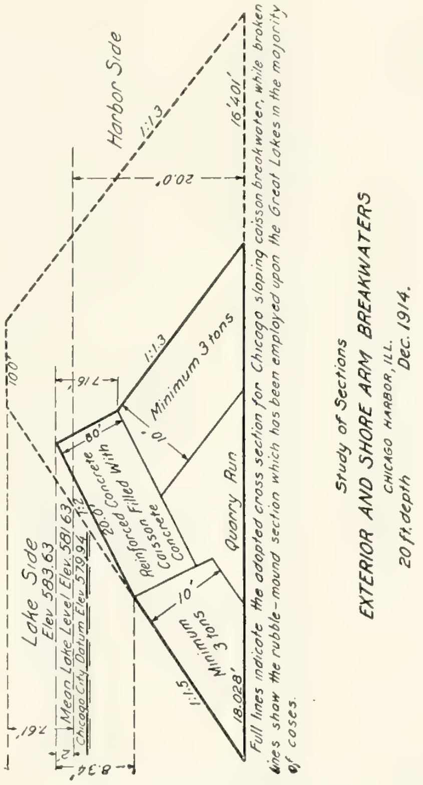
The constructing of concrete caissons at a more or less permanent yard permits of the installation of a suitable plant and the organization of a good working force, both of which will tend to materially reduce the cost of manufacturing and launching the caissons and also the total cost of the proposed structure.

While in small caissons it is best to have them mono-cellular, in order to decrease their dead weight without making the side walls too thin, in large caisson work it is best to have numerous chambers or compartments, since the cross walls can be made of substantial thickness without any appreciable effect upon the buoyancy. Still, it is not believed that in many cases it would be true economy to use caissons which would be lighter in weight than conditions of buoyancy require.

Since it is possible to sink the caissons quickly to position by means of water ballast, they become safe against moderate wave action in a very short space of time after arriving at their final resting place. When sunk the tops of the caissons project above water, thus permitting of the compartments being pumped out in rotation and the interior fill placed in the dry. This affords a cheaper and more substantial system of permanent subaqeuous construction than any other mode.

With the cost of timber slowly advancing and temporary structures becoming things of the past except in undeveloped countries, permanent concrete construction is rapidly advancing to the front. While there is probably much to be learned about reinforced concrete floating caissons, and much educational work to be done among contractors, in no other field (of engineering), apparently, will reinforced concrete make greater strides in the immediate future than in such works as breakwaters, piers, dock-fronts, revetments, bridge piers and similar structures where reinforced concrete caissons may be employed.

Fig. 6.



Full lines indicate the adopted cross section for Chicago sloping caisson breakwater, while broken lines show the rubble-mound section which has been employed upon the Great Lakes in the majority of cases.

Concrete caissons used in a sloping position on Chicago Harbour breakwater.

From the great advantage to be derived from floating concrete caissons in harbor development, it would seem that this branch of concrete engineering will find a wide field of applicability now that the use of concrete in sea water is more thoroughly understood by American engineers. In view of the success obtained in foreign countries and the wider use of the system being made yearly, it would seem that with an unrestricted use of the system in the United States upon the expiration of Colonel Judson's patents, the use of floating concrete caissons will be more widely adopted by United States engineers, for if they have been successfully used in deep foundation work why not in hydraulic engineering?

The Use of Oxy-Acetylene Equipment in Welding and Cutting

THE following notes are based on data compiled by The Travelers' Insurance Company (Engineering and Inspection Department), Hartford, Conn. Particular attention may be drawn to the paragraphs relating to the precautions necessary to avoid mishaps in the manipulation of acetylene generators and oxygen containers under high pressures, and to minimize the danger to the bodily well-being of the workman using high-temperature gas flames in the welding and cutting of metals.

The ordinary method of welding, and the one that has been in common use for many years, is that known as the compression process. By this method the pieces to be welded are heated in a forge to a temperature slightly above the proper degree for welding. The two ends, after being treated with a suitable flux to decrease scale and shut out air, are placed together, and a compressive force, usually created by hammering, is depended on to form a junction. The smith must be able to judge the proper temperature for welding, make sure that the flux is applied properly, and then hammer the adjoining ends so that slag, scale and air are forced out. It is evident, then, that the efficiency of the weld depends very much on the skill of the operator and the thoroughness with which he performs his work. This process, when properly carried out, is satisfactory for small operations, such as the ordinary work in a blacksmith's shop, but it is entirely unsuited for the demands of modern, up-to-date repair shops, where large sections of boilers, engines, and other heavy parts of metal are to be joined, because of the uncertainty of the weld and the time and labor involved.

From time to time attempts have been made to weld metals by using oxygen in combination with a combustible gas. Hydrogen, "Pintsch," and "Blau" gas have been tried, but were not found satisfactory because of temperature limitations. If sufficiently confined, the flame from any one of these would be hot enough to melt most of the common metals; but experience shows that these gases cannot be sufficiently well regulated or localized, in commercial work, to give wholly satisfactory results.

The introduction of the electric furnace has made possible the production of calcium carbide in large quantities, and from this acetylene gas is made. The combination of oxygen and acetylene, when ignited, produces the oxy-acetylene flame by over 2,000 deg. F. The extra heat generated by the oxy-acetylene flame not only melts the metals to be joined, but also fuses them so completely that they run together automatically, thus forming a weld. In addition to the fifty per cent. increase in intensity of heat in the oxy-acetylene flame over other oxygen flames, there is about 500 per cent. increase in the amount of heat. Another valuable feature of the oxy-acetylene flame is its concentration into a small volume at the working point, as compared with other flames—a condition especially suited for rapid and thorough welding and cutting.

Generation of Acetylene

Generation of Acetylene.—There are two methods for generating the supply of acetylene for welding and cutting operations—one generally called the carbide-to-water plan, and the other the water-to-carbide plan. The first makes use of a cylinder partly filled with water into which calcium carbide is dropped by a mechanism controlled by the pressure of the gas in the cylinder. This has the double advantage of producing the largest volume of gas per unit of carbide, while the gas is also separated from certain of its impurities by bubbling up through the lime water.

On the other hand, the water-to-carbide method is very apt to reduce the calorific value and the amount of acetylene produced per unit of calcium carbide, and at the same time form a tar product which will clog up the pipes, valves, and torches. For these reasons, among others, the superiority of generators of the carbide-to-water type is generally acknowledged.

Storage of Acetylene.—It is not safe to store gaseous acetylene in tanks under a pressure approaching two atmospheres; and to overcome this difficulty storage tanks are provided, containing a porous substance such as brick or asbestos, and filled with acetone. Acetylene gas is then pumped into the tanks, and this combines with the acetone, which has the property of absorbing approximately twenty-five times its volume of acetylene for each atmosphere of pressure, at 60 deg. F. By this process acetylene may be safely stored under a pressure of 150 lbs. to a square inch.

A great deal of the success of oxy-acetylene welding depends on the torch. The low-pressure, or injector-action torch, is used in connection with acetylene under a pressure of a few ounces. A chamber in the torch permits the accumulation of a small quantity of acetylene, and the oxygen passing through this chamber, under pressure, carries along a certain amount of acetylene, usually in quantities of 1 part of acetylene to from 1.6 to 1.8 parts of oxygen. This excess of oxygen, besides being wasteful of the oxygen itself and increasing the length of time required for making the weld, tends to oxidize the metal, thus forming a brittle, unsatisfactory joint.

To overcome this defect the high-pressure or positive-mixture torch was designed. In this torch both the acetylene and the oxygen are admitted under pressure, the ratio being 1 part of acetylene to from 1.13 to 1.15 of oxygen. Since both the acetylene and the oxygen are under a pressure of several atmospheres, reducing valves and pressure gauges are employed to regulate the flow of the gases in the correct proportion to produce rapid and satisfactory welding and cutting.

The Generation of Oxygen.—The quality of the oxygen has an important bearing on the efficiency of the welds, and for this reason it is essential to see that the impurities, incident to the generation of oxygen, are eliminated. This is practically impossible in a portable pressure-generator, since some of the deleterious impurities, such as chlorine, must pass through nearly 100 feet of washing fluid before they are removed. In a stationary oxygen-generating outfit, however, it is quite easy to provide the necessary amount of washing fluid, and to store the oxygen in tanks. This increases the cost of the oxygen, but, since better results are obtained, the ultimate cost of the weld is no doubt less than with a portable generator.

If portability is essential, it is recommended that both the oxygen and acetylene be obtained from storage cylinders. A portable acetylene generator has the disadvantage of requiring the removal of either the water or the calcium carbide before the generator can be taken safely from one place to another. If neither the water nor the calcium carbide is removed, and the generator tips over, the mixture of all the water and carbide will generate large quantities of gas, causing an explosion; or in case of a small leak the escaping gas may become ignited, thus causing severe burns.

Precautions for Safety.—A number of accidents have occurred due to the practice of using an open-flame light when cleaning out an acetylene generator. It is customary to wait until the pressure gauge indicates no gas in the generator before cleaning operations are started. Sometimes a small pocket of the gas remains, however, and burns the workman when ignition takes place from the open flame. Calcium carbide will occasionally cake on the sides of the generator tank, and unless the water is removed at once the caked carbide will generate gas as it is knocked from the tank, and will ignite and burn the workman. A portable incandescent electric lamp should be used instead of an open light, and the lamp bulb should be protected against breakage by a fibre or wire guard.

The tubes or hose connecting the torch with the acetylene and oxygen supply are constantly subjected to twists, turns, and abrasive action, and are apt to be so weakened that minor leaks occur, or the fastenings may become loosened and permit gas to escape. The torch itself provides a flame that will ignite the escaping gas, or the sparks from the welding or cutting operation may also light it. Occasionally gas escapes from loosened fastenings and gathers about the clothing of the man wielding the torch. Sparks from the burning metal then cause the gas to ignite, severely burning the workman. This indicates that the hose fastenings and the hose itself should be frequently inspected to see that no leaks exist or are likely to occur during an operation.

It is essential that colored glasses be worn by everyone connected with oxy-acetylene welding or cutting work. Not only should the eyes be protected from the intense light of the oxy-acetylene flame, but also from the very fine, slag-like substance that occurs during the welding operations, and which is decidedly harmful to such sensitive organs as the eyes.

Very little, if any, attention has been given to the subject of the effect of the oxy-acetylene welding upon the health of the workers. The amount and intensity of the heat from the flame is sufficient to cause evaporization of the metals, and since the workman's head must be within a foot or two of the flame he cannot avoid breathing the products of combustion unless some protection is provided. It would seem that a helmet, with a colored-glass front, would afford the necessary protection in this way, as well as protect the eyes from the intense light.

The economy and efficiency of this method of making welds and cutting metals has led to its adoption in many of our manufacturing plants, and this in turn has created an oxygen-generating industry. The cost of transportation is such, however, that the oxygen is usually sold in cylinders in which it is stored under pressures up to 1,800 lbs. to a square inch. Should one of the cylinders be defective a destructive explosion is apt to result. To guard against accidents to the workmen from this cause, the cylinders should never be stored in the working room, but should be kept in a special storage room having substantial walls. Care should also be taken to avoid leaving full tanks in places where the direct rays of the sun may strike them, or in close proximity to heating apparatus or any other sources of heat.

A New Bituminous Pavement with Pulverized Clay

DURING the last three years a bituminous pavement has been laid on several streets in Iola, Kansas, which is a mixture of asphalt cement and pulverized clay or loam. The parties developing the method have been proceeding cautiously while studying details of construction and working out machinery for treating the mineral matter entering into the pavement.

A. W. Dow, of Dow & Smith, chemical engineers, says of this pavement:

The "National Pavement" is composed of asphalt cement mixed with pulverized clay or loam which may contain more or less sand or fine stone. Owing to the strong affinity for bituminous materials like asphalt cement possessed by the colloidal silica and silicates contained in clay and clayey soils, and also to the fine state of division of the pulverized clay, a very soft asphalt cement may be used in the mixture without danger of producing a pavement too soft for traffic. In this respect it has a distinct advantage over other types of bituminous pavements, for it is a well-known fact that the softer the asphalt cement used the longer the life of the pavement, provided it is not so soft as to roll under traffic. As to the wearing qualities of this paving material, no one can say from a practical experience, but, judging from its characteristics, it is hard to appreciate how it can be worn away. The wearing cannot take place in a manner similar to the other types of bituminous pavements constructed with sand and coarse mineral aggregate. In these materials the coarse mineral matter slowly pulverizes under traffic and grinds away, but in the case of the National Pavement the clay is already pulverized to as fine a condition as possible, and there cannot be any further grinding of the particles. One great advantage which this paving material possesses over that of other bituminous pavements is that it is made of finely pulverized clay with little or no gritty particles contained in it. It will not have the same wearing effect on rubber tired vehicles, which are now so much in use on our public highways.

In constructing this pavement, a specially designed machine thoroughly pulverizes the soil which is fed into it (which may be that excavated from the road in grading), at the same time evaporating the moisture contained therein and heating all material to the degree necessary for uniform and easy mixing. The machine now in use is the third built by the company, each of the two last being an improvement over its predecessor. There are two drums, the inner of which has blades on the outer circumference. The outer drum acts as a heater. The inner revolves at a rate of about 600 r.p.m., and the blades, which are arranged normal to a helix so that the material is worked toward one end, throws the material against the outer drum. It is raised by flights on the inner surface of the outer drum (which revolves slowly), and as it falls back it is again caught by the blades, this process being repeated until all the earth is pulverized completely and comes out as flour. A screen prevents unpulverized particles from coming out. Any sand particles come out clean and bright.

The bituminous binder is then mixed with the pulverized, dried, and heated material in a regular asphalt mixer. The product as it comes out resembles pulverized rock asphalt more than it does sheet asphalt, though it can be handled in the same way as the latter. It is hauled to the road, spread, and rolled when sufficiently cool. The material which has been used as mineral aggregate is a clayey sub-soil excavated from the street to be paved. This material, which is commonly known as gumbo soil in the Middle West, is considered the most refractory soil or clay to work up into paving—yet it was readily pulverized and mixed with the asphaltic cement. Some of this pavement was laid over three years ago, and is still in good condition. Concerning it Mr. Dow says: "It is smooth, and there is little tractive resistance. At the same time it is noiseless under the hoofs of horses and sounds soft, although it does not mark nearly as badly as does a sheet asphalt pavement under the same temperature conditions. It has been subjected to considerable heavy traffic since being laid, the traffic consisting of heavy wagons loaded with dirt and with narrow iron tires." Most of the pavement has been laid on a rolled and drained earth base, although some has been laid on top of an old brick pavement. While figures of the cost were not given, it would seem that this must have been less than for a sheet asphalt pavement, since the aggregate is obtained at no expense other than that of pulverizing it. The amount of asphalt binder used to a cubic yard of pavement is almost exactly the same as for standard sheet asphalt; but, owing to the use of very fine mineral aggregate only, the combination is said to be more than merely mechanical, being more like a dense colloidal solution.

Wood-Stave Pipe for Water-Power Penstocks

By Robert E. Horton*

THAT many kinds of wood will last indefinitely when either air-dry or completely saturated is well known. In the case of wood-stave pipe the former condition is impossible, and an intermediate condition of partial saturation and partial dryness is usual. The extremely short life, even of the best selected wood, under conditions of partial saturation, especially when exposed in a warm, humid atmosphere, does not seem to have been fully realized in the earlier history of wood-stave pipe construction. As a result of experience gained, in some cases through costly failures, the conditions under which durability of wood-stave pipe may be best attained are now well known. The staves must be completely and continuously saturated; they should be perfectly sound and of the very best material; and the fibres of the wood must not be injured or broken in erecting the pipe by over-cinching or drawing the bands too tight.

Experience has shown that in the majority of cases, except where pipe is buried in soils containing acids or strongly alkaline ground-waters, the durability of the bands is greater than that of the staves. For durability the bands should be as large as is compatible with securing watertightness of the pipe and at the same time avoiding crushing of the fibre underneath the bands. The same conditions as to quality of material and coating of the bands apply as in the case of steel pipe if durability is desired.

Steel vs. Wood Pipe

Where large steel pipes are used under low pressure a certain minimum thickness of metal must be used to provide stiffness, and as a safeguard against rapid development of leakage at rust spots. For very large, thin pipes stiffening rings also are added to prevent excessive deformation of the pipe by its own weight. In the case of continuous wood pipe the economical thickness of staves required for structural reasons and to secure water-tightness is sufficient to provide adequate stiffness in most cases.

In wood-stave pipe, as in steel, the pressure is resisted entirely by metal. In the case of wood-stave pipes with bands having rolled threads or upset ends the full strength of the metal can be developed to resist tension. In the case of riveted steel pipe, especially for low heads, a large amount of metal is required in excess of that needed to resist tension due to water pressure. From considerations of economy in erection the riveted joints used for low pressures have generally relatively low efficiencies, so that only a fraction, varying commonly from 40 to 65 per cent. of the strength of the metal in the pipe walls, is available to resist pressure.

These conditions indicate an important field of usefulness for wood-stave pipe for water-power penstocks or portions of penstocks which are of large diameter and under relatively low heads. As the head increases, the joint efficiency which can be commercially realized in steel pipes is increased, and the percentage of metal added for other than tension purposes is decreased, so that for heavy pressures the amounts of metal required in wood-stave and steel penstocks would aproach equality.

The conditions determining which of these two types of penstock will be most efficient and economical in a given case are: Relative first cost or improvement; relative durability; relative cost of repairs and maintenance; and relative carrying capacity or, more properly, relative power output with conduits of a given size.

Relative Costs

The relative cost must, of course, be determined for each specific case. Large steel penstocks in the Eastern States commonly cost from 3.5 to 5 cents a pound, erected, exclusive of cradles or other supports. No simple general rules for estimating the cost of continuous wood-stave pipe can be given. The materials are mostly obtained from the Pacific Coast, and formed staves at the mills cost from about $30 to $35 a thousand feet, board measure, for Douglas fir, to $45 for redwood.

Freight is a large element in determining both the cost of wood-stave pipe and the relative economy of wood and steel. In general, the advantage of stave pipe over steel increases proceeding westward from the Eastern States, owing to reduced freight rates on wood and increased freight on steel. Formed staves take the standard lumber classification freights; freights will probably be reduced somewhat on materials for wood-stave pipe by shipment to Eastern points via the Panama Canal.

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*Consulting hydraulic engineer, Albany, N. Y., writing in Engineering Record.

Steel conduits are commonly supported on concrete cradles, though sometimes buried or partly buried in earth. The cost of wood-stave conduits is materially affected by the method of support. Support on timber trestles is usually the cheapest. For large pipe above ground concrete cradles are preferable, and the cost and spacing is about the same for wood-stave and steel pipes.

Should Wood Pipe Be Buried?

Formerly, continuous wood-stave pipes were commonly buried in the earth—first, from considerations of economy as compared with the cost of concrete or other permanent cradles; second, on the supposition that burying the pipe was conducive to its durability. Experience has shown that the staves of continuous wood-stave pipe are least durable when partially buried or when buried in porous soils, such as sands or gravels. Wood pipe is perhaps the most durable when buried below the line of saturation of the soil or in compact clay soils, where the pipe surface will be kept constantly moist by the prevention of evaporation of seepage through the staves.

Conditions where the pipe can be buried below ground-water level are very rare, and in such cases the cost of unwatering the trench during pipe construction is likely to inhibit the use of this method. Again, pipe cannot be buried where there is rock at the surface, and if buried in the soil under conditions otherwise favorable for durability the bands will be destroyed rapidly if the ground-water is either strongly alkaline or contains humic acid from the decay of surface vegetation, as is commonly the case in woods. The pipe is not accessible to repair when buried, and while apparently it is necessary to bury wooden pipe in some instances as a protection against landslides in mountainous regions, yet in the majority of cases wood-stave pipe should not be placed underground unless the conditions are all favorable, and even then only when a calculation, based on economical considerations, gives a result in favor of placing the pipe underground.

As an illustration the calculation in Table 1 is given, in which it is assumed that the life of the buried conduit without repairs would be 15 years, whereas its life above ground, properly maintained and repaired, would be forty years.

Table 1.—Illustration of Relative Cost of Buried and Unburied Pipe

Condition	On Crades	Buried
Cost of pipe per foot	$13.60	$15.50
Cost cradles or trench	$6.40	$1.50
Total investment	$20.00	$17.00
Life, years	40	15
Repairs, per cent. per year	1	0
Annual Charges		
Interest, at 6 per cent.	$1.20	$1.02
Depreciation:		
At 2½ per cent.	$0.50	.....
At 6 2-3 per cent.	.....	$1.02
Repairs	$0.20	$0.00
Total annual charges per foot	$1.90	$2.04

The comparison given is for pipe 9 ft. in diameter under an average head of 60 ft. It is assumed that the pipe above ground is supported by concrete cradles. This increases the first cost per foot materially over that for the buried pipe, but even then, owing to the rapid depreciation of buried pipe, the calculations show the total annual charges per foot of pipe to be considerably less for the pipe supported above ground on cradles.

It is generally conceded that the carrying capacity of new wood-stave pipe with a given friction loss is somewhat greater than that for new riveted steel pipe. There is some diversity of opinion as to the amount of difference. The writer believes that the later formulae for the capacity of these two classes of pipe are substantially correct, and that there is a material difference in favor of wood-stave pipe when new as compared with steel when new. Of the two, steel pipe is also subject to much the greater increase in friction head or decrease in carrying capacity with increased age. Probably the Hazen and Williams formula represents the best determination of the carrying capacity or friction head for steel pipes. The Moritz formula is probably the best available for application to large wood-stave conduits. In a somewhat later review of the experiments Andrew Swickard gives the formula

$$n = (D/30{,}000) + 0.0105$$

where n = coefficient of roughness to be applied in the Kutter-Chezy formula, and D is the inside diameter of the pipe, in inches. This formula is convenient for those who prefer to work from the Kutter formula or diagrams based thereon.

For pipes 9 ft. in diameter, with velocities of 6 ft. per second, the friction head is as follows:

Riveted steel pipe, Hazen and Williams formula, with $C = 110$, friction head 1.06 ft. per thousand.

Riveted steel pipe 10 years old, Hazen and Williams formula, with $C = 100$, friction head 1.26 ft. per thousand.

Wood-stave pipe, Hazen and Williams formula, with $C = 120$, friction head 0.9 ft. per thousand. With the Moritz formula the friction head equals 0.60 ft. per thousand.

The friction loss by the Moritz formula is considerably less than by the Hazen and Williams formula. The two results may be reconciled in some degree by considering that Moritz's formula applies to new pipe properly constructed and in the best condition, whereas friction head given by the Hazen and Williams formula would, in the writer's opinion, only apply to average pipes in service as heretofore constructed, many of them being improperly constructed and in some cases subject to deposits of sand and sediment in the pipe inverts. Even when free from sediment and properly constructed, the carrying capacity of wood-stave pipe may be reduced somewhat by growth of slime and spongilla on the interior surface, which slightly decreases the effective diameter and increases friction by throwing off small eddies, although not decreasing the apparent smoothness of the surface.

In comparing the merits of steel and wood pipe conduits for specific cases, the relative carrying capacities should be taken into consideration, as illustrated by the example which follows. The relative cost or value of conduits of different materials having different degrees of roughness is sometimes arrived at by estimating the difference in cost of conduits which are of different sizes but which will carry equal quantities of water with the same total loss of head. In the writer's opinion this method is not generally applicable in the case of conduits for power purposes. In such cases there is usually a maximum permissible velocity determined by conditions of speed regulation or governing. Economy dictates that whatever material is used the fixed maximum velocity should be equalled but not exceeded. Accordingly the conduit should be of the same diameter, in the majority of cases, regardless of the material or friction loss per foot of length. If the velocity is the same in both and the friction loss in wood-stave is less than in steel pipe at the given velocity, the average net head available at the power plant will be greater if the wood-stave pipe is used, and the market value of the average increase in power so obtained is one of the items to be considered in determining the relative economic values of the two types of conduits.

Power Gained by Reduced Friction

The gain in power should be estimated from the increase in head available with the plant operating at its average load, not at its maximum load. The power gained by reduced friction in the conduit is obtained at very little expense. The power and speed of the turbine are increased by increased head. Generator costs are smaller per unit at the higher speeds, and there would be no material difference in attendance or overhead charges in the two cases.

Instead of calculating the gain in marketable power due to increased head as clear profit, it is perhaps safer to estimate the value of the increased power pro rata the same as the value of the average power output of the plant.

Relative Economy of Wood and Steel

Table 2 shows a comparative estimate of the cost of wood-stave and steel penstocks each 9 ft. in internal diameter and 2,000 ft. long. The figures are based on recent bids for a conduit in central New York. In this case the computation shows some apparent economy in favor of wood-stave pipe regardless of increase in power. It will be noted that taking into account the increase in power, the result of such a calculation may indicate that it is an economical advantage to use wood-stave pipe even where the first cost is equal to or a little greater than that for steel pipe.

Table 2.—Illustration of Method of Determining Relative Economy of Wood and Steel Conduits

	Steel Pipe	Wood Stave Pipe
First cost of pipe	$17.40	$13.60
Concrete cradles	6.00	5.00
Total investment	$23.40	$18.60
Life assumed	40 yr.	30 yr.
Depreciation rate	2½%	3 1-3%
Repairs	0.5%	1%
Annual Charges per foot of Pipe		
Interest and taxes at 7 per cent.	$1.638	$1.302
Depreciation	0.585	0.620
Repairs	0.117	0.186
Total	$2.340	$2.108
Total for 2,000 ft. conduit	$4,680	$4,256
Value of power gained, 25 h.p. at $10 per h.p.-year	00	2.50
Annual balance	4,680	4,006
Net saving with wood pipe		$594
Capitalized saving at 8 per cent.		$7,425

In the case on which the figures given are based, wood-stave pipe was not used, in spite of the economic showing in its favor, because of the general feeling of uncertainty then prevalent regarding the durability and conditions tending to produce long life for wood-stave pipe. It is highly desirable that the conditions governing the durability of wood-stave pipe should be more generally understood and accepted:

First, to prevent repetition of serious mistakes of the past, where wood-stave pipe has been used under conditions to which it was not well adapted.

Second, to prevent its rejection in cases where it clearly shows a decided economical advantage over steel.

Wood-stave pipes have been used for casings of artesian wells in oases in northern Egypt for more than 2,000 years. These pipes are placed within square timber curbing, and the space between the square curbing and the pipe is packed with clay. Under these conditions the staves are always saturated. It could hardly be expected that the wood from which these Egyptian pipes are constructed (acacia nilatica) would last more than a decade if exposed to the air and partially saturated.

Complete and perpetual saturation of the staves being the prime requisite, to secure durability care should be taken that the thickness of the staves is not too great in proportion to the pressure. If durability is desired, wood-stave pipe should not be used unless it will be continually filled with water under a static pressure head of from at least 20 to 30 ft. The staves are made from stock sizes of timber, and their exact size and thickness for a particular case are governed by the smallest commercial size of board from which the stave can be cut. This is best determined by an accurate full-size drawing of the stave section. Thickening the staves increases the stability of the pipe against deformation, and generally is conducive to water-tightness at the joints or seams. The staves should not be so thick as to prevent a reasonable amount of percolation through the pores of the wood under pressure. To meet these conditions the following formula was devised by the writer for use in preliminary determination of stave thickness:

$$T = 1 + h/100 + d/100$$

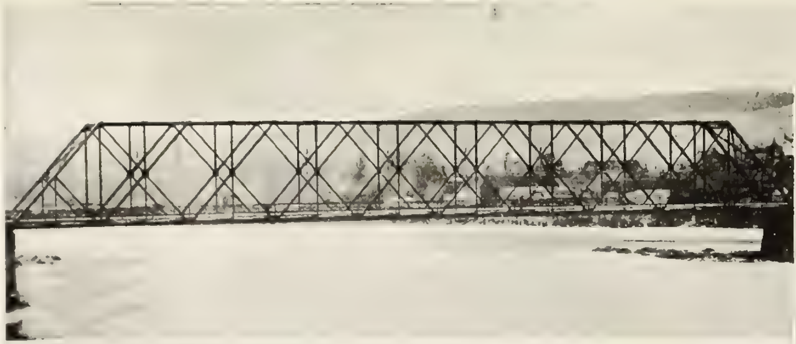
where T = thickness of staves in inches; h, head in feet; d, diameter of pipe in inches. It is believed that staves determined by this formula will have the maximum of durability consistent with reasonable stiffness of the pipe.

Light Highway Bridges

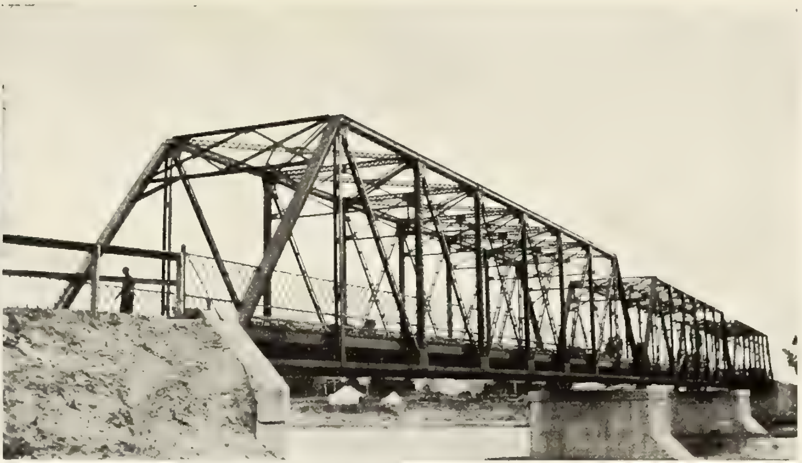
IN addition to the larger and heavier bridges necessitated by the traffic increase and gradual expansion of the larger towns and cities, there is a growing demand for steel spans in the smaller towns and municipalities. These are generally for the lighter kinds of service and are often built under subsidy from Provincial Governments or even by these Governments direct. The Provinces of the Dominion have their own specifications in every case for this class of structure, and these specifications differ considerably in different places. In the Province of Quebec a number of bridges for country and small town traffic have been built, and in recent years the majority have been designed to meet the Provincial specifications drawn up by Mr. L. A. Vallee. A number of typical light highway spans are illustrated herewith.

The two spans at Richmond, Que., were built in 1903 and still enjoy the distinction of being the longest riveted highway spans in existence. They are 370 ft. 10 ins. long, 20 ft. wide, and 40 ft. deep. The flooring is of wood, as are also the stringer joists. The floor is designed to carry an 8-ton wagon or 100

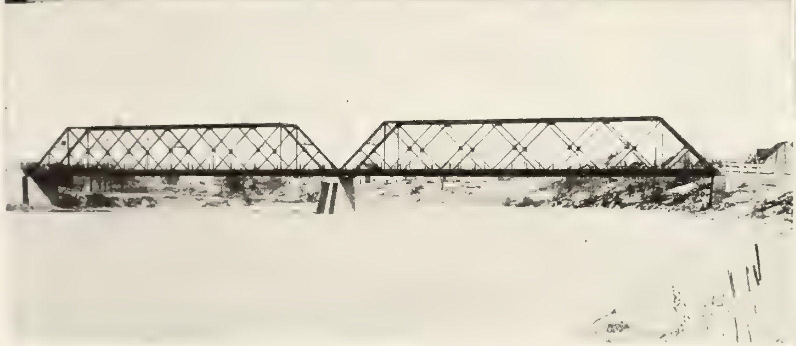
Light Highway Bridge Designs



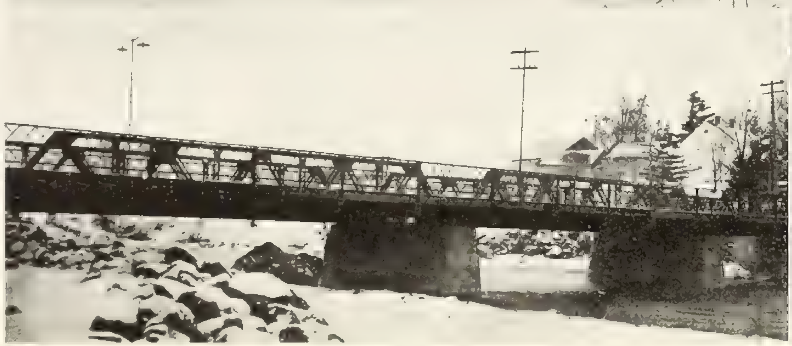
At Richmond, Que.



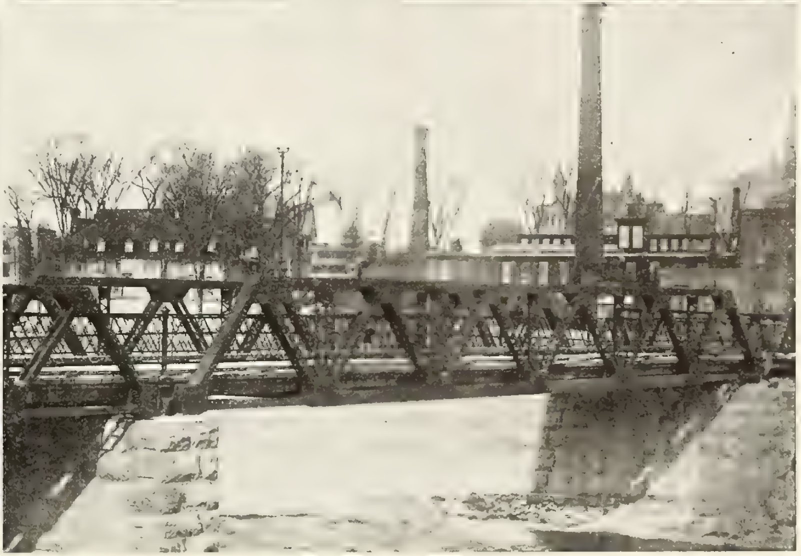
At Drumheller, Alta.



Centre illustration on left is at St. Hyacinthe, Que.

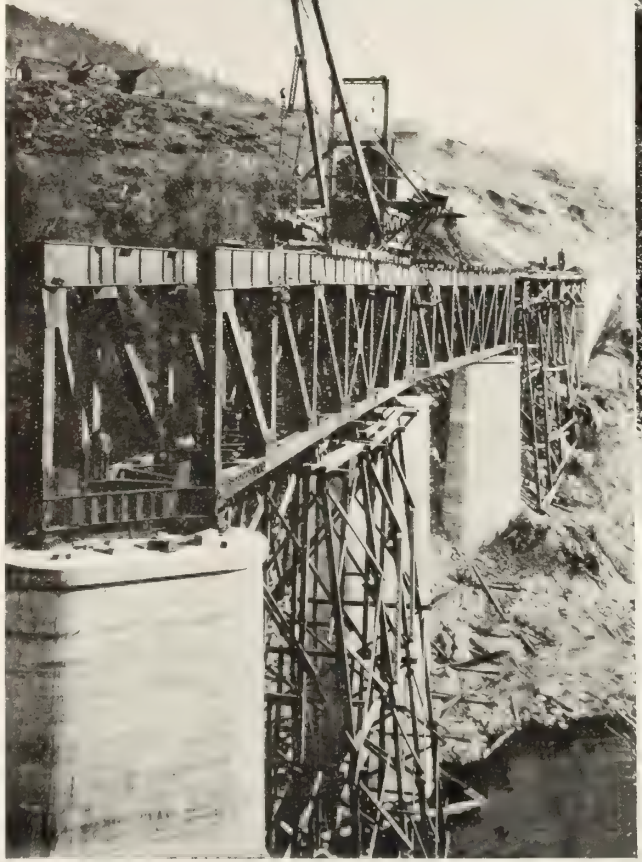


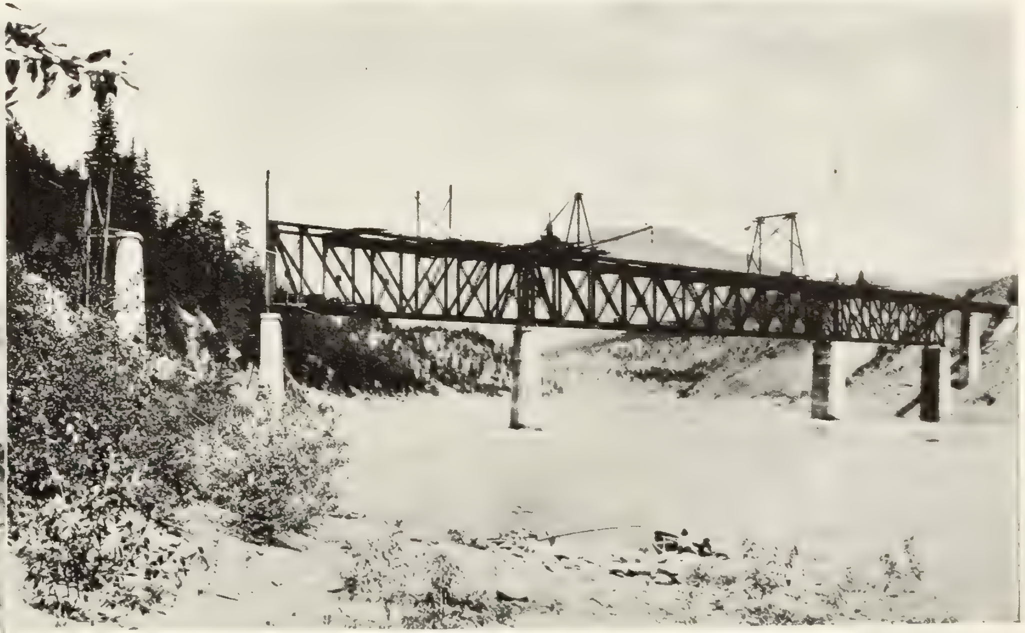
At Magog, Que.



At St. Hyacinthe, Que.

Two Canadian Northern Bridges in British Columbia





These illustrations show two of the bridges completed in 1914 on the line of the C. N. P. R. in British Columbia. The photograph on the left is of Bridge No. 3 over the Thompson River near its junction with the Fraser, while the other picture shows Bridge No. 2 over the Fraser just south of the junction of the Thompson River. Both were built to the designs of Messrs. Waddell & Harrington and consist mainly of deck truss spans on very high concrete piers. Bridge No. 2 contains about 1,340 tons of steel, and there are 733 tons in Bridge No. 3. The illustrations are published by courtesy of the Dominion Bridge Company, who erected these spans.

pounds per square foot. The trusses are designed for a load of 60 pounds per square foot. Each span weighs 189 tons.

The Barsalou Bridge at St. Hyacinthe, Que., includes the two spans shown in the cut, which were built in 1914. They are 81 ft. and 91 ft. in length respectively, and weigh about 29 tons and 34 tons. Each is designed to carry a 20-ft. road with a loading of 100 pounds per square foot, and two sidewalks. The floor system is able to carry 15-ton wagons.

The Morrison Bridge, also at St. Hyacinthe, consists of two through truss spans 210 ft. long, built with an 18-ft. roadway for loading similar to that of the Barsalou Bridge. The weight of steel in each span is 113 tons.

The bridge over the Magog River at Magog, Que., is of the pony truss design with an 18-ft. roadway to carry a 20-ton wagon. It has one sidewalk and the flooring and stringers are of timber.

The Drumheller Bridge at Drumheller, Alta., was built for the Alberta Government in 1914. It consists of three spans of about 150 ft. The bridge was fabricated in the Winnipeg shop of the Dominion Bridge Company, and is representative of a number of bridges made there for the West.

Cost of Trench Work Through Brick Pavement for Wire Conduit

THE trench in point was as near as possible to the curb, and crossed under two sets of street-car tracks and two street intersections, says a writer in Engineering and Contracting. The costs given are for tearing up brick pavement down to grout base, trenching sand cushion and replacing same, relaying brick pavement and slushing with cement filler for laying a wire conduit for ornamental street lights. They also include the cost of sixteen 1 ft. 4 in. square holes about 16 ins. deep, cut through cement and stone sidewalks, filling these holes with concrete, and setting four base bolts in each hole. The cost for the post holes, etc., was as follows:

Item	Total	Per hole
Labor cutting, 25 hrs. at .50 cts.	$12.50	$0.78
Labor concreting	5.00	0.31
Total labor	$17.50	$1.09
12 wood templets for base bolts	3.00	0.19
2 cu. yds. concrete at $3.60	7.20	0.45
Miscellaneous	1.12	0.07
Total materials, etc.	$11.32	$0.71
Grand Total	$28.82	$1.80

The cost of the trench 1½ ft. wide and 1,130 ft. long was as follows:

Item	Total	Lin. ft.
Tearing up and cleaning brick	$21.37	$0.019
Relaying brick	27.95	0.025
Teaming	4.00	0.004
Total labor	$53.32	$0.048
2 cu. yds. cushion sand	3.00	......
4 bbls. cement	6.00	......
00 new brick	4.00	......
Miscellaneous	5.00	......
Total materials	$18.00	$0.016
Grand total	$71.32	$0.064

Carrying Concrete Road Over Trenches with Soft Backfill

IN constructing concrete pavement at Elizabeth, N.J., soft filling of old gas, sewer, and water trenches in several places proved impossible to compact by roller to the solidity of the approach sub-grade. To excavate and refill would have been costly, and recourse was had by the engineer to a method of bridging. He excavated the whole intersection 3 ins. in excess of the contract requirements, rammed broken stone in the trenches and when sufficiently dry applied 9 ins. of concrete over the whole surface thus prepared. The specifications were not exactly followed by so doing, but the sub-grade was prepared in such a manner that the extra concrete would bridge the trenches in a satisfactory manner. To make repairs to the road when cut through for future trenches a somewhat similar construction is planned, as follows: The concrete will be cut 6 ins. wider on each side than the excavated trench, and will be excavated 3 ins. below the sub-grade on the shoulder; the refill must be made as compact as possible. The old concrete must then be cut as a skew back on each side so that the opening is 4 ins. wider at the top than at the bottom. Number ten expanded metal or its equivalent of ½-in. steel bars are to be placed 2 ins. above the newly prepared sub-grade; the space is then to be filled with concrete while the sides of the old pavement are fresh cut and clean. After setting a sufficient time, while guarded against traffic, it is to be recoated with bitumen.

Expansion joints will be repaired with a suitable brand of hot paving pitch, poured into the joint after it has been cleaned of loose foreign material, and the edges cleaned by chisel or other suitable tool, after which it will be filled with ½-in. gravel and then allowed to set.—Engineering and Contracting.

Canadian Northern Railway Bridges in B.C.

AT Kamloops, B. C., the Canadian Northern Railway recently completed their girder type lift bridge across the North Thompson River. This fine bridge, which is 1,209 feet long, with approaches making 1,123 feet additional, is unique in Canada, it being the first bridge in the Dominion having a vertical lift span. The lift span, which is 93 feet long, can be raised vertically to 55 or 57 feet above high-water level. It was designed by Messrs. Waddell & Harrington, consulting engineers, Kansas City, Mo.

The lift span, consisting of a 93-ft. deck plate girder, weighing about 236,000 pounds, is balanced by counter weights attached to cables which pass over sheaves at the top of the towers. There are four 1¼-inch cables at each corner of the span, and equalizers are used on the span side to distribute the load properly to each rope. The span is guided along the sides of the front tower columns during its movement, the guides being detailed so as to allow proper movement at the expansion end under temperature and live load changes. The counterweights, likewise, are guided along the sides of the towers.

Centring castings are used at the ends of the span to bring the span in proper alignment when it is seated. These castings also take the thrusts from moving trains. Special rail castings are used at the ends of the lift span to give continuity to the rails at these points when the span is down, and at the same time locks are provided for each end of the bridge. The span is raised and lowered by means of cables fastened at the top and bottom of the towers.

These cables pass over drums at each corner of the span, which are actuated by a number of gears and shafts connecting to a gasoline engine at the centre. All the machinery is below the deck except the operating levers and indicator, which are located in the operator's house, supported at the level of the deck from the side of one girder. A limit switch is used in the igniter circuit to cut off the engine after the span has passed a certain point in both its up and down movements. Contacts are likewise placed on the clutch level so as to control the igniter circuit in conjunction with the limit switch. A hand-brake is installed with the machinery for manual control of the engine.

Arch bridge at Cisco Canyon, Fraser River.

The greater part of the machinery is enclosed between the girders just below the deck at the centre of the span, and is accessible from the operator's house by means of a stair and door through one of the girders. Hand operation is also provided for. The machinery is designed to lift the span 53 feet in 100 seconds, providing a clearance of 55 feet above high-water. Though the Kamloops Bridge is the first of its type yet built in Canada, the St. John and Quebec Railway will erect a similar one across the Oromocto River near Fredericton South, N. B.

There are only two other bridges of this type yet in operation—one is over Pond Oreille, at Sand Point, Idaho, and the other is over the Big Choctaw Bayou, in Louisiana. This bridge on the Louisiana and Texas Railroad carries single-track traffic. It has a 50-foot lift span of the through-plate girder type, which is fully balanced by concrete counterweights and is operated by hand by one man. This span can be raised to the full height of 47 feet above high-water in ten minutes. The piers are of concrete on pile foundations, as in the Kamloops Bridge.

It is claimed for the vertical lift bridge that it is a simple span in which all stresses are determinate, and similar to those of a fixed span. It is economically adapted to skew crossings, to construction on a grade, and to future change of elevation of grade; it is as rigid as a fixed span; it may be paved like a fixed span; and since the floor is always horizontal, spans of any length may be built, and the longer the span the greater the comparative economy of the vertical lift bridge. The wind has no effect upon the towers or span, for they expose small areas to it. The span is fully counterweighted, so that the operating machinery has only to overcome friction and inertia; and but one operator is required, no matter how large the open channel.

High Level Bridge at Cisco, B. C.

Herewith is shown a view of Bridge No. 1, crossing the Fraser River, B. C., five miles down stream from Lytton, at mile 140 east of New Westminster Bridge. The view is from the up-stream side, looking towards the C. P. R. Cisco Bridge, shown in the distance.

This bridge, starting from the west end, is composed of one 77-ft. deck-plate girder, one 40-ft. tower, one 81-ft. deck-plate girder, one 40-ft. tower, one 106-ft. deck-plate girder, one 425-ft. arch span, and one 40-ft. deck-plate girder span at the east end of the bridge. The total length is 809 ft. Erection was carried on from both ends. The arch span was erected by a cantilever system from both ends. The material and derrick for the east half of the span were taken across to the east side of the river by means of a cable. The height of the bridge above low-water is 198 feet.

Five wells in the southern part of the Province of Alberta have now produced oil in greater or less quantities. The results show that the oils are of a varied nature and that they compare favorably with oils from some of the well-known fields of the United States.

A new type of lift design at Kamloops, B.C.

Personal Mention

Lieut. R. F. Morkill, Signal Engineer of the Grand Trunk Railway, who is now at the front, has been promoted to the rank of Captain.

Mr. E. J. Holland has resigned his position as City Engineer of Guelph, Ont., and the City Clerk has been instructed to advertise for a new City Engineer.

Among the Montreal officers mentioned by Sir John French for gallant service in the field is Lt.-Col. F. O. W. Loomis, of the firm of D. G. Loomis and Sons, contractors, Montreal.

Mr. Louis A. Amos, architect, of Montreal and Lachine, Que., has been elected Mayor of Lachine, in succession to the late Mr. J. T. Rathwell. Mr. Amos was elected Alderman in 1913, and was Chairman of the Public Works Committee.

Messrs. Tetley & Doggart, architects, formerly of 78 Crescent Street, Montreal, have dissolved partnership, and Mr. C. R. Tetley, A. R. I. B. A., is practising his profession alone, with offices at 304 University Street. Mr. Doggart has gone to Milwaukee, Wis.

Mr. George S. Hanes, Mayor of North Vancouver, and former City Engineer of Windsor, Ont., was a visitor to that city recently. He congratulated the City Council on the many improvements that had been made in the city, and said that the factory district of Windsor was a move in the right direction.

A meeting of the Royal Institute of British Architects held in London, England, on June 21st was made the occasion of the presentation of the Royal Gold Medal for Architecture to Mr. Frank Darling, of Toronto. As reported in our issue of March 17 last, Mr. Darling is the first architect of any of the overseas dominions of the Empire to receive this medal, which is the highest architectural honour to which any architect in the world can aspire. As Mr. Darling was unable to be present in person, Sir George Perley received the medal at the hands of President Newton of the R. I. B. A. Among the Canadians present at the meeting were Donald MacMaster, W. L. Griffith, Dr. Armour, and A. G. Colmer; and there were also representatives from the other overseas dominions.

Mainly Constructional

East and West From Coast to Coast

Curtis Brothers' brickmaking plant at Peterborough was badly damaged by fire recently, when practically all of the machinery was ruined and two frame buildings were completely destroyed. The loss is not covered by insurance.

Considerable activity is noted in municipal work at Hull, Que. Plans have been prepared for a water-main system to cost $116,000, and tenders will be called shortly. Plans have also been drawn for a sewer to be constructed in the city.

In connection with their underground conduit scheme, the city of Montreal are installing an electric fire alarm system on St. Catherine and Bleury Streets and Park Avenue. The contractor will supply and install all the cables, fire alarm boxes, pedestals, etc.

A branch of the Canadian Society of Civil Engineers has been organized in Regina. At the initial well-attended general meeting the following officers and executive committee were appointed: Chairman, O. W. Smith; Secretary, L. W. Wynne-Roberts; Executive Committeee, A. J. McPherson, F. McArthur, and I. N. de Stein.

Montreal building supply houses report a slight improvement in business. The brick trade is looking up, and some orders have been booked for Newfoundland and the Maritime Provinces. A fair amount of building is going on in the province of Quebec, and a satisfactory proportion of the supplies are ordered through Montreal firms.

Before accepting bids for paving blocks the Montreal Controllers made minute inquiries from the representatives of the firms tendering as to the prices at which similar goods had been offered in Toronto. It has been freely stated that, apart from differences in freight, Toronto has been able to secure such materials as paving blocks, asphalt, etc., at lower prices than Montreal.

From Calgary, Alta., comes the report that work will be recommenced on a nine-storey block of offices and stores there. The foundations, steel work and concrete floors were done two years ago, and preparations are being made to enclose the building and to finish five floors. As the total cost of the building is placed at $325,000, the report is rather encouraging as regards the condition of constructional activities in the West.

The sub-contract for steel for a new bridge at Stadacona Road, Quebec, Que., has been let to the Eastern Canada Steel & Iron Works, Limited. The bridge will consist of two spans, 80 ft. and 70 ft. long respectively, on a concrete substructure. The width of the bridge will be 25 ft. and a 4-in. red pine floor will be laid. The cost of the structure is estimated at $116,000.

At Renfrew, Ont., the Jamieson Brick and Tile Company have decided to operate another brick and tile yard. They have been having tests made of clay on certain lands, and as this has been found of suitable quality the company will erect machinery and kilns on this site. It is understood that some new lines of manufacture will be undertaken in connection with this expansion of the business.

The bondholders of the Ontario National Brick Company, Limited, will meet in Montreal on August 17 to consider a plan to cancel the interest coupons for 1915, 1916, and 1917, accepting in their place bonds of the current series aggregating at their par value the amount of the coupons maturing for the three years, plus interest at 6 per cent. per annum on that amount for a year and a half.

Toronto is still looking for a start on the building of its new Union Station "the first of next month." The rumour that the C. P. R. was about to withdraw from the Terminal Company and abandon its part of the work has been denied by officials of that company. It is understood that the railways consider the building of the new station "a useless expenditure" at the present time. According to the last order of the Dominion Railway Board, the station must be completed by July 29, 1916. It is stated, however, that it would be impossible to build the station in less than three years, although it might be opened to the public in two and a half years.

The front of the new Post Office at St. John, N.B., has been uncovered, and it is expected that the interior will be finished and the building be ready for occupation in a few months. The first storey of the front is finished in gray granite, and the remaining three storeys in freestone. The ground area is about 150 x 100 feet. The cost of the structure is estimated at $390,000.

Seven tenders have been received for the construction of a new storage dam on the St. Lawrence River, for the Quebec Streams Commission. The dam will be situated at La Loutre, about a hundred miles north of the new railway development. It will be over 1,000 feet long, and its depth at the deepest part will be 85 feet. The area to be flooded will constitute one of the greatest reservoirs in America.

The reinforced concrete floor of the new bridge at St. John, N.B., is nearing completion. This part of the work was delayed last fall by severe frost. The city approach is complete, and the contractor expects to commence work on the Carleton Street approach immediately. The trimming of the bridge will not be completed until after the old bridge is removed. It is stated that the new bridge will be ready for traffic early in August.

The new public building at Brantford, Ont., was opened recently, it having been finished within the time specified. The building consists of four floors, and cost approximately $300,000. It is occupied by the Post Office, Customs, Inland Revenue, and Indian Affairs Departments. The contractors were P. H. Secord & Sons, and the work was carried out under the supervision of Mr. C. W. Hall, the architect. Mr. J. Graham was Clerk of the Works.

The construction programme brought down by the City Commissioners at a recent meeting of the City Council of Regina, Sask., provides for a total expenditure of $278,961. The details of construction include: Works, $177,927; sewage disposal works, $10,500; domestic sewers and water-works, $60,282; street railway, $10,000; Health and Relief Department, $1,655; and Light and Power Department, $29,117. The estimates include also provision for water-main extensions in certain parts of the city. The Commissioners do not think that the amount must of necessity be spent this year.

After having awarded a contract for resurfacing asphalt roads to the Simplex Paving Company without having called for tenders the Montreal Board of Control discovered that they had exceeded their powers, and notified the Council that they withdrew their report on the subject. Notwithstanding this, the Council by a majority awarded the contract to the company. The City Attorney has now decided that this action is illegal, as the granting of contracts is solely within the jurisdiction of the Controllers, and, besides, the Council cannot act on a report which has been annulled. The Controllers, therefore, will call for new tenders.

Notice has been received by the London Industrial Bureau that the annual convention of the Ontario Architects' Association will be held in London during fair week. It has also been decided that the Association's annual exhibition which is held at the Toronto Industrial Exhibition every year is to be forwarded to London and exhibited at the Western Fair. John M. Watt, of Watt & Blackwell, architects, is Chairman of the exhibition committee of the Association, and has been working for the last five months to secure this convention and exhibition for London, the matter having been decided at the regular meeting of the council of the Association held in Toronto recently.

Representatives of the municipalities interested in the Toronto-Oshawa road are to meet in Toronto to advance the project. It is likely that one result of the meeting will be the submission of a request to the Ontario Government to bring into effect the Highway Bill passed last session. It is stated that the Government has decided not to assume any financial obligations under the Act this year, but there is nothing to prevent its being brought into effect this year. In this case the municipalities may get all their plans ready for a start on actual construction next year. The counties now carrying on road construction under the 33 1-3 per cent. grant from the Government will not obtain the increase to 40 per cent. until next year, it is understood, even if the Act is brought into force earlier.

According to a Quebec despatch, a company has been incorporated under a provincial charter, with a capital of $3,000,000, to develop and supply hydro-electric power in the cities of Quebec and Three Rivers, and also to operate in several counties of the province. Three of the incorporators are Directors of the Shawinigan Water and Power Company, and two are Directors of the Dorchester Electric Company, operating in the city of Quebec. The assets of the Dorchester Company are to be sold, and the Shawinigan Company are credited with the intention of securing a controlling interest. The incorporation of the new company is apparently a move in this direction. In the event of the Shawinigan Company supplying power to the Dorchester Company it will be necessary to build a transmission line from Shawinigan to Quebec.

A dispute has arisen at Burlington, Ont., similar to that reported from Montreal in connection with tenders for paving material. At Burlington, however, the subject of the tender was sewer pipe required by the town for the installation of its new sewerage system. The town advertised for tenders for the supply of material and also for tenders for the construction of a complete sewerage system. Tenders were received and opened by the Sewer Committee, and the Engineer directed that the sewer pipe tenders be held over until he had an opportunity of reporting further. The Council, however, adopted the recommendation of the Sewer Committee, and decided to accept a tender for pipe which was $564.81 above the lowest tender. The dispute has resulted in the taking out of an injunction and a mandamus to compel the Council to accept the lowest tender or to renew its advertisement for tenders.

The City of Hull lost its appeal in the Court of Review against the lower court judgment condemning it to pay to P. Wilson et al the balance of an account in connection with drain excavations undertaken by the latter in Hull. The plaintiff sued the city for $5,016, claiming that the plans indicated earth excavation, but that when the work proceeded a portion was almost entirely rock, and he asked for the difference in the cost. The City of Hull pleaded that the contract was a fixed price; there was no representation that the excavation was earth and not rock, and the plaintiff should have satisfied himself as to the nature of the work before commencing. Chief Justice Archibald and Justices Saint-Pierre and Bruneau found that, as the plans were made, any contractor would consider that they indicated earth excavations, and there could be no question that the city knew the plaintiff was contracting for earth excavation. The defendant knew that the plaintiff valued rock excavation at $3, and at this price the plaintiff's tender would have been greatly increased.

The Controllers of Montreal have ordered plans to be prepared for the extension of the water filtration plant now under construction. Messrs. Hering & Fuller, the New York consulting engineers, have advised that the extension be of the mechanical type, increasing the daily capacity from 50,000,000 to 100,000,000 gallons. The following are the comparative estimated costs of different types under consideration for the additional filter unit: Double filtration (present type), $1,750,000; slow sand filtration, $2,100,000; mechanical filtration, $900,000. The total expenditure on the entire scheme, including the widening of the aqueduct, will be $4,500,000, made up as follows: Expropriation of land and retaining wall, $225,000; fencing, $35,000; draining ditches, $25,000; culverts, $15,000; entrance to aqueduct, $475,000; entrance gates, $100,000; bridges, $560,000; retaining walls, including $110,000 for additional plain concrete, $675,000; hydro-electric power house and equipment, $1,500,000; second filter unit, $900,000. It was explained that the test wall of the aqueduct had disclosed certain defects which made it essential to strengthen the two retaining walls at a cost of $675,000. Owing to the nature of the soil, the walls as originally designed were not strong enough, and the test wall had cracked at the base. It is proposed therefore to spend $565,000 on additional reinforced concrete work and better drainage, and $110,000 on unreinforced concrete work.

City Engineer a Paid Employee

The rights and powers of the City Engineer in the matter of altering plans and specifications in contracts for construction, and how far the contractor may expect payment for additional work so entailed, were illustrated in a judgment rendered in the Court of Appeals by Chief Justice Sir Horace Archambeault, confirming the judgment of the trial court in the case the Harris Construction Company vs. the City of Montreal, whereby the appellant's claim for $9,916 was held to be invalid.

The company appellant had undertaken sewer construction work for the city in 1913, and, having finished the work in 1914, had received payment of $193,900. The appellant made an additional claim for $21,591, which the city refused to pay, and an action resulted. In the course of the hearing the appellant made a further incidental claim for $9,916 for extra work, resulting from changes in the work which had been ordered by the City Engineer. The city alleged that such extra work had never been authorized, to which the appellant replied by the allegation that ever since the city had existed the work ordered by it had been executed on the orders of its engineers, that such orders had never been disputed, and that the custom of leaving the execution of the work to the discretion of the engineers was recognized by the city.

The city thereupon inscribed in law against this part of the appellant's answer, and the trial court sustained the inscription, declaring that the facts adduced were irrelevant to the main issue and would involve a long and useless inquiry. From this judgment the appeal was made. Though the company appellant admitted that no increase in price could be claimed by a contractor by tender according to plans and specifications without authorization in writing by the proprietor, it alleged that the City Engineer represented the city as holding a commission to have the work carried out, and that the changes ordered by him in writing were the act of the city itself.

"In the first place," said His Lordship in confirming the judgment, "the engineer who was charged by the city to superintend the work held no commission from the city, but was merely one of its paid employees. His powers are defined in the contract made between the appellant and the respondent, and he can in no wise obligate the city for a sum exceeding the total for which the contract has been awarded. Secondly, it must not be forgotten that the city is no ordinary proprietor; it is a corporation the powers of which are defined by a charter, and can legally incur obligations only in accordance with the terms of this charter. Moreover, Article 337 of the City Charter specifies that no contract whatever is binding upon the city unless first approved by the Council or Board of Control, and that the city is not responsible for the price or value of works done without the special authorization of the Council or Board of Control.

"This Article 337 ends by stating that no right of action against the city exists unless the formalities mentioned have been strictly observed, even if the city has benefited by the contract. It may be seen that an order from the City Engineer is not sufficient to bind the city. Therefore, when the company appellant alleges that the work carried out and for which it claims payment was ordered by the engineer charged with superintending the work it does not show that it has any right of action against the city. Even if the city had never disputed the orders of its Engineer in the past, it would not on that account have been bound by the order which may have been given by its Engineer in the extension of the present contract."

On this page we illustrate the cover of a new catalogue issued by Knox Motor Associates, Springfield, Mass. The catalogue is devoted to a description of the many varied applications of the Knox tractor, which is described as a motor vehicle which hauls its load after the manner of a railroad engine instead of carrying it as does the ordinary type of motor truck. By separating the power vehicle from the carrying vehicle it is claimed that not only can the efficiency of the power plant be multiplied, but also the uses to which the power may be put. This tractor allows from sixty to one hundred per cent. of the paying load to roll on steel-tired trailers. Since the trailer may be detached from the tractor, there is no necessity to keep the tractor waiting for the loading or unloading of the trailer. The adaptability of this class of vehicle for hauling different kinds of material such as long sticks of lumber, structural steel, sand, blockstone, etc., is apparent. The number of trailers can be varied according to the class of material to be handled. In fact, the Knox tractor amounts practically to a trackless locomotive.

Knox Catalogue Cover Design.

What is said to be the largest country road contract ever let in America was executed last week under the award made by the commissioners of Multonomah County, Ore., which includes and surrounds the city of Portland. The bulk of the work is for hard surfacing with Warrenite under license of the patents of Warren Brothers Company, of Boston. This surfacing will be laid over the old macadam roads. Contracts aggregating $1,250,000 were let under bonds approved during the last winter. The allotment of contracts includes seventy-four miles to be surfaced with Warrenite, the work being divided amongst four contractors. The average cost of the work is approximately $14,000 a mile.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Blenheim, Ont.
The construction of cement sidewalks and curbs on various streets has been authorized by the Town Council. Engineer, C. E. Wharram.

Blind River, Ont.
Sidewalks, estimated to cost $3,500, will be constructed during the summer for the Town Council. Clerk, W. F. Dyke.

Brockville, Ont.
The Board of Works have been instructed by the Town Council to lay tarvia pavement on St. Audrew Street by day labor. Engineer, G. H. Broyson.

Hamilton, Ont.
The City Council have started work by day labor on the construction of sidewalks, estimated to cost $22,000, and watermains. Material is being purchased by A. P. Kappele, Secretary to the Works Department.

The City Council intend to lay a quantity of asphalt, asphaltic concrete and wood block paving by day labor. Material to be purchased by A. P. Kappele, Secretary to the Works Department.

Hensall, Ont.
Tenders will be called shortly by the Town Council for the construction of cement sidewalks on Alfred and Albert Streets. Clerk, A. Murdock.

Hull, Que.
The City Council have had plans drawn for sewers and watermains. Tenders will be called shortly. Estimated cost of watermains, $116,000. Clerk, N. Boulay.

Ingersoll, Ont.
The Town Council will receive tenders until July 5th for the construction of approximately 7,175 square yards of vitrified brick pavement on concrete base, with 3,500 feet of combined curb and gutter. Plans at office of the Town Clerk, W. R. Smith, and with the Contract Record, 347 Adelaide Street W., Toronto.

Kamsack, Sask.
The Town Council have authorized the construction of an addition to the waterworks system, estimated to cost $35,000. Clerk, H. H. Crawford.

Lambeth, Ont.
The Village Council are about to install a waterworks system, at an estimated cost of $15,000. Work will include well drilling. Engineers, J. A. Bell & Son.

Leamington, Ont.
It is proposed to lay a pavement on Erie Street this summer. Town Clerk, R. M. Selkirk.

London, Ont.
The City Council contemplate laying sewers into the Fair Grounds. Clerk, Samuel Baker.

The City Council are considering the construction of asphalt pavement on York and Talbot Streets. Engineer, H. A. Brazier.

The Water Commissioners propose to install an 8-inch watermain and fire hydrants in the Hillcrest Survey. Manager, E. V. Buchanan.

Millardville, Ont.
The estimated cost of the proposed municipal water installation is $8,175. Reeve, J. Marmont.

Mosa Township, Ont.
A quantity of tile drain construction is being considered by the Township Council. Clerk, C. C. McNaughton, Newbury, Ont.

New Glasgow, N. S.
The Town Council have decided to lay bitulithic pavement on Archimedes Street. Engineer, E. S. Fenser.

Oshawa, Ont.
The Town Council have passed a bylaw to authorize the construction of sewers and concrete pavement on certain streets. Clerk, Thomas Morris.

Pelee Island Township, Ont.
Extensions to the drainage system are contemplated by the Township Council. Work will involve some blasting. Clerk, W. Stewart, Pelee Island P. O.

Plymouth Township, Ont.
The Township Council propose to construct a tile drain this season. Clerk, T. Nisbet, Wyoming P. O.

Prince Albert, Sask.
The City Council are considering the construction of a watermain on Fifteenth Street W., at an estimated cost of $14,000, and the laying of a sanitary sewer on the same street, estimated to cost $11,000. Clerk, J. H. Brown, Eighth Eighth Street East.

Quebec, Que.
The Civic Roads Committee have approved the following pavements:—Sacred Heart Street, $4,000; Marie Louise, St. Raphael and Montmagny Streets, $5,000; Beauport Road, $8,000; Charlesbourg Road, $6,000; Little River Road, $3,000. Engineer, W. D. Baillairge.

Renfrew, Ont.
The Town Council are about to lay macadam paving on Coombs and Hall Streets by day labor. Estimated cost, $7,750. Engineer, J. R. Stewart.

Regina, Sask.
The City Council have ordered that an early start be made on the following works:—waterworks, $44,500; watermains extensions, $10,680; domestic sewers, $11,324; street railway extensions, $10,000. Clerk, George Beach.

Rochester Township, Ont.
The Township Council are about to submit a by-law to provide for the expenditure of $30,000 on the construction of tile, stone and timber drains. Clerk, M. N. Rousseau, South Woodslee, Ont.

Scotstown, Que.
Work will shortly commence on the construction of pavements for the Town Council. Approximate cost, $5,000. Clerk, Samuel Boy.

St. John, N. B.
Work is about to start on the construction of sewers on Peter, Acadia and Chesley Streets for the City Council. Engineer, W. Murdock.

Stratford, Ont.
The City Council have approved the construction of cement sidewalks on several streets. Engineer, A. B. Manson.

Toronto, Ont.
The Board of Control will receive tenders until July 6th for one steam pump for hydraulic operation of gate valve at the High Level Pumping Station. Plans, etc., at Works Department, City Hall.

Trenton, N. S.
Plans for the construction of sewers have been submitted to the Town Council, and tenders will be called for shortly. Clerk, W. Fraser. Estimated cost, $3,300.

Waterloo, Ont.
Plans for the construction of concrete walks on various streets have been passed by the Town Council. Engineer, F. Moogk.

Windsor, Ont.
Tenders will be received until June 30th by the City Clerk, W. A. Hanrahan, for the supply of 300 tons of 6-inch, 80 tons of 8-inch and 700 tons of 20-inch cast iron water main, 10 tons of specials, five 20-inch, one 12-inch and two 10-inch valves.

CONTRACTS AWARDED

Bertie Township, Ont.
The contract for the construction of the Point Abino drain has been let to John D. Smith, Crystal Beach, Ont.

Blenheim, Ont.
A contract for the construction of sidewalks and curbs for the Town Council has been let to John Scoyne, at 10½c. per square foot for walks, 11½c. per foot for crossings and 19c. per lineal foot for curbs.

Brussels, Ont.
The Village Council have let the contract for laying a permanent roadway to Thomas McLean & Company, Wingham, at $2,950.

Humberstone, Ont.
The contract for the construction of sidewalks for the Village Council has been awarded to Chester Johnson, Ridgeway. Approximate cost, $3,500.

Kingston, Ont.
The Civic Utilities Commission have awarded a contract for waterworks construction to Kingston Construction Company, Limited, Kingston. Approximate cost, $5,000. City will lay pipe.

Lachine, Que.
The City Council have awarded the contract for the construction of a reser-

voir to the Dominion Bridge Company, Limited, Lachine, at $19,376.

A contract for the construction of storm sewers on Dundas Street has been let by the Board of Control to the Webster Construction Company, Bank of Toronto Chambers.

London, Ont.

The contract for laying asphaltic concrete paving on Ridout Street for the City Council has been let to the Standard Paving Company, Limited, Central Chambers, Ottawa, at $30,300.

Mariposa Township, Ont.

The Township Council have let a contract for drainage work to Kehor & Yule, Beaverton, at $5,877.

Oshawa, Ont.

The Town Council have let the contract for the construction of approximately 30,000 square feet of concrete sidewalks to Walter Flintoff, Oshawa, at 9½c. per square foot.

Peterborough, Ont.

The City Council have let a contract for the construction of about 15,000 square yards of pavement to the Warren Paving Company, 103 Bay Street, Toronto, and to the Standard Paving Company, Central Chambers, Ottawa, for the same amount.

Sandwich, Ont.

The Town Council have let the contract for the construction of concrete paving on Askin and Mill Streets to the Chick Contracting Company, 225 Bruce Street, Windsor, at $17,000, and on London and Church Streets to Caldwell Sand & Gravel Company, 84 Sandwich Street W., Windsor, at $20,000.

Simcoe, Ont.

A contract for laying pavement and sidewalks has been awarded to the Maple Leaf Artificial Stone Company, Simcoe, at $5,300.

Toronto, Ont.

A contract for the construction of a sewer on the Weston Road from St. Clair Avenue to the City Limits has been let by the Board of Control to the Orpen Contracting Company, 165 King Street West.

Windsor, Ont.

The Board of Works has recommended that a contract for concrete paving on Giles, Niagara and Karl Streets be awarded to G. S. Curry, 117 Jeanette Avenue, at $10,200.

Railroads, Bridges and Wharves

Brantford Township, Ont.

The Township Council have let the contract for the construction of two reinforced concrete bridges to George Thompson, 223 West Mill Street, Brantford.

British Columbia Province

The Pacific & Great Eastern Railway, 325 Howe Street, Vancouver, are about to continue their line from Lillooet to Hundred Mile House, 223 miles from Vancouver. Chief Engineer, J. Callaghan.

The Department of Public Works, Ottawa, are considering the construction of two floating wharves, with approaches of about 200 feet each. Secretary, R. C. Desrochers, Ottawa.

Calgary, Alta.

Permission has been granted the Canadian Pacific Railway for the construction of a spur for the Simington Company, Limited. Head office of Company, Montreal.

Edmonton, Alta.

The Canadian Northern Railway have been authorized to construct a spur line into the premises of the Edmonton Stock Yards Limited. Purchasing Agent, E. Langham, Winnipeg.

Gowanshown, Ont.

Tenders on the construction of a steel and concrete bridge will be received until July 10th by the Township Council. Clerk, David Greer.

Hastings County, Ont.

The construction of six concrete bridges is being considered by the County Council. Estimated total cost, $9,500. Clerk, A. P. Chapman, Belleville.

Joliette County, Que.

The Canadian Pacific Railway have been authorized to construct a spur for H. de Chires, St. Felix de Valois, County Joliette.

Locust Hill, Ont.

A report has been presented to York County Council by Engineer E. A. James, 57 Adelaide Street E., Toronto, estimating the cost of a high level bridge over Little Rouge River at $18,000 for steel and concrete construction, and at $20,000 for steel construction.

North Timiskaming, Que.

Tenders will be received until 4 p.m., July 12th, by the Department of Public Works, Ottawa, for the construction of a four span steel bridge over Quinze River. Plans and specifications at offices of the District Engineers, Shaughnessy Building, Montreal, or Confederation Life Building, Toronto, with the Postmaster, Hamilton, and at the Department.

Perth and Wellington Counties, Ont.

Tenders on the construction of a bridge will be received until July 24th by G. H. Dickson, R. R. No. 1, Moorefield, and by the Engineers, Bowman & Connor, 31 Queen Street W., Toronto.

Sandwich, Ont.

The contract for constructing a bridge for the Town Council has been let to Merlo, Merlo & Ray, Jackson's Corners, and for the construction of a retaining wall to Richard McKee, Sandwich.

Tillsonburg, Ont.

Tenders on the construction of a steel bridge on Simcoe Street will be received until July 5th by the Town Clerk, A. E. Raynes. Plans and specifications at office of the Clerk.

Toronto, Ont.

The Board of Control will receive tenders until July 6th for the supply of two portable cross-overs, right and left hand turn-outs, and No. 60 rail. Plans and specifications at office of the Works Department, City Hall.

Vaudreuil County, Que.

The Canadian Pacific Railway have been authorized to construct an industrial spur and extension for the Canadian Explosives, Limited, Ile. Perrot, Vaudreuil Station.

Wellington County, Ont.

Plans are being prepared for Dennie's Bridge, Howe Bridge and a boundary bridge between East and West Garafraxa. County Clerk, James Beattie, Fergus.

CONTRACTS AWARDED

Eel Brook, N. S.

The Municipality of Argyle have let the contract for the construction of a bridge to W. J. Stewart, E. Pubnico, N. S., at $12,500.

Marysville, N. B.

The contract for the construction of two storage dams on the Nashwaak River for the Edward Partington Pulp & Paper Company, Limited, St. John, N. B., has been let to the Ambursen Hydraulic Construction Company of Canada, Limited, New Birks Building, Montreal.

River Glade, N. B.

The contract for the construction of a concrete dam for the Jordam Memorial Sanatorium has been awarded to F. L. Boone, St. Mary's, York County, N. B. Approximate cost, $25,000.

Toronto, Ont.

In connection with the construction of a bridge over the C. P. R. tracks at Strachan Avenue the Board of Control have let the contract for concrete and masonry substructure and concrete flooring to Roderick Campbell, 15 Toronto Street, at $23,045, and for steel superstructure to the Dominion Bridge Company, Victoria Street, at $5,091.

Vancouver, B. C.

In connection with repairs to Connaught Bridge for the City Council, the contract for the supply of steel has been let to Coughlan & Sons, Front and Columbia Streets, and the contract for dismantling and erecting to the Coast Contracting Company, 16 Hastings Street E. The City will supply rails, and furnish and lay wood block pavement.

Virden, Man.

The general contract for the construction of bridges and culverts for the Municipality has been awarded to W. T. Manser, Queen Street, Virden, $5,500.

Woburn, Ont.

The Scarboro Township Council have let the contract for steel work for the bridge to be erected over Rouge River to the Sarnia Bridge Company, 176 North Street, Sarnia. Concrete abutments will be built by day labor. Approximate cost, $22,000.

Public Buildings, Churches and Schools

Cardston, Alta.

The School Board are receiving tenders for the excavation and foundations for a school. Plans and specifications with the Secretary, J. E. Harris. Approximate cost, $40,000.

Georgetown, P. E. I.

The Congregation of St. James are considering the erection of a frame and concrete church at an estimated cost of $4,000. Architect, C. B. Chapelle, Box 93, Charlottetown.

Hope, B. C.

Tenders on the erection of a large one-roomed addition to the school will be received until July 10th by J. E. Griffith, Deputy Minister of Public Works, Victoria. Plans and specifications at office of H. P. Christie, Government Agent, Ashcroft, J. Mahoney, Government Agent, Court House, Vancouver, T. E.

Scott, Secretary to the School Board, Hope, and at the Department, Victoria.

Lavington, B. C.

Tenders on the erection of a large one-roomed school will be received until noon, July 5th, by J .E. Griffith, Deputy Minister of Public Works, Victoria. Plans and specifications at offices of R. W. Paton, Secretary to the School Board, Vernon, and L. Norris, Government Agent, Vernon.

Little Current, Ont.

R. Hay, Secretary to the School Board, will receive tenders until July 15th on the erection of a public school, estimated to cost $15,000, and separate tenders on heating and ventilating. Brick veneer construction.

Malakwa, B. C.

J. E. Griffith, Deputy Minister of Public Works, Victoria, will receive tenders until noon, July 6th, on the erection of a large one-roomed school. Plans and specifications at offices of E. T. W. Pearse, Kamloops, R. Gordon, Government Agent, Revelstoke, A. C. Carr, Secretary to the School Board, Malakwa, and at the Department.

Marmora, Ont.

The erection of a separate school is being considered by the congregation of the Roman Catholic Church. Pastor, Rev. Thomas Murtagh. Architect not yet appointed.

Motherwell, Ont.

The School Board are considering the erection of a school. Architect not yet chosen. Trustee, W. Bolton, St. Marys P. O. Estimated cost, $5,000.

Oakville, Ont.

A by-law providing for the erection of a school at a cost of $65,000 has been defeated. It is expected that the School Board will ask for $25,000 for building a four-roomed school. Town Clerk, W. E. M. Crawley.

Point Pelee, Ont.

Tenders on the erection of a life-saving station will be received until noon, July 9th, by G. J. Desbarats, Deputy Minister of Public Works, Ottawa. Plans and specifications at offices of the District Engineers, Toronto and Windsor, at the Life Saving Station, Point Pelee, and at the Department.

Richmond, B. C.

The erection of a Municipal Hall will be discussed at an early meeting of the Council. Clerk, E. S. Wilson.

Scarboro' Junction, Ont.

Tenders will be received until July 10th for the erection of a two-roomed addition to Kennedy Road School, Section No. 10. Plans at office of the Secretary, P. Heron, Scarboro' Junction.

Southampton, Ont.

The Board of Education have appointed a committee to investigate the cost of a heating system and seating for the school. Secretary to the Board, Andrew Bannister.

Stratford, Ont.

A by-law to provide for alterations to the City Hospital has been defeated.

St. Catharines, Ont.

The Public School Board have decided to alter and renovate several schools. Secretary, Charles T. McBride.

Summerside, P. E. I.

The proposed annex to the Prince County Hospital, Central Street, will be built by day labor. Clerk to the Hospital Board, H. J. Massy.

Toronto, Ont.

The Board of Education have approved plans for an addition to McMurrich School, and tenders for the work will be called shortly. Secretary, W. C. Wilkinson.

Three Rivers, Que.

Further to the report published in our issue of June 16th, the time for receiving tenders on the erection of a school for the Roman Catholic School Commissioners has been extended indefinitely.

Winnipeg, Man.

Tenders have been received for the erection of the First Christian Scientist Church on River Avenue. Separate tenders for electric fixtures, seating and organ will be called for. Architects, Jordon & Over, 47 Canada Life Building. Estimated cost, $60,000.

Yarmouth, N. S.

The Department of Public Works, Ottawa, are considering the erection of a Post Office. Secretary, R. S. Desrochers, Ottawa.

CONTRACTS AWARDED

Brantford Township, Ont.

The contract for the supply of stone for the school in Section No. 6 has been let to the Corinthian Stone Company, G. T. R. Junction, Guelph.

Barrie, Ont.

The general contract for the erection of a hall on Owen Street for the Masonic Temple Company, Limited, has been awarded to R. F. Garrett, 61 High Street. Approximate cost, $5,000.

The Department of Public Works, Ottawa, have let the general contract for the erection of a drill hall on Small Street to W. A. Tom, Collingwood, the masonry contract to T. Tooke, Barrie, the contract for carpentry, steel work and roofing to Rusk & Catlin, Allandale, the painting contract to Philip Love, 123 Mulcaster Street, Barrie, and the electrical contract to C. Cherry, 70 Russett Avenue, Toronto.

Canboro, Ont.

A. M. Lymburner, Cayuga, is erecting a church for the Methodist Congregation, estimated to cost $5,000. Brick construction.

Elmwood, Man.

The School Board have let the general contract for the erection of George V. School to Worswick Bros., 123 Hart Avenue, at $41,229. Stone, sandlime brick and reinforced concrete construction.

Fredericton, N. B.

The sub-contract for sheet metal work and roofing in connection with the annex to the Victoria Hospital has been awarded to James McDade, Mill Street, St. John.

Hamilton, Ont.

The general and masonry contracts for the erection of a lodge hall on Main St. E. for the Independent Order of Foresters have been let to W. Finden, 291 St. Catherine Street N., the carpentry contract to D. Reilly, 559 Hughson St., and the contract for steel work to the Hamilton Bridge Company, Bay Street N. Estimated cost, $5,000.

Hull, Que.

In connection with the school being erected on Farley Street for the Roman Catholic Commissioners, the masonry contract has been awarded to J. Dufresne, Langevin Street.

Work has been started on the erection of the Faley Street School for the Roman Catholic School Commissioners by Louis Lemieux, Laurier Avenue. Estimated cost, $23,000.

Milan, Que.

The general contract for the erection of a school for the Municipality has been awarded to Alexander Nicholson. Approximate cost, $3,500. Fittings will be required.

Ottawa, Ont.

The contract for heating and plumbing in connection with St. Lucas Evangelist Church, McKay Street, has been let to C. Wyman, 249 Creighton Street.

Port McNicholl, Ont.

In connection with the public school being erected on Seventh Avenue for District No. 16, Township of Tay, the contract for Corinthian stone has been let to Corinthian Stone Company, G. T. R. Junction, Guelph.

Princeton, B. C.

In connection with the erection of a Post Office and store for Alex. Bell, the general, masonry, carpentry, roofing and plastering contracts have been awarded to W. Wilson, the painting contract to Max Wilson, the contract for plumbing to F. Hale, and for electrical work to G. McDonald.

Toronto, Ont.

The contract for plumbing in connection with the Polish Catholic Church on Gillespie Street has been let to G. E Wimpenny, 59 Boon Avenue, the painting contract to T. J. O'Connor, 64 St. Clarens Avenue, and the contract for roofing and galvanized iron work to J. Gow, 300 Arthur Street.

The Board of Education have let the contract for an iron fence around the grounds of the Technical School, Lippincott Street, to the Dennis Wire & Iron Works Company, Limited, London, Ont., subject to approval.

Victoria, B. C.

The general contract for the erection of an observatory on Little Saanich Mountain for the Department of Public Works, Ottawa, has been let to the McAlpine Robertson Construction Company, 837 Hastings Street West, Victoria. Approximate cost, $75,000.

Walkerville, Ont.

The masonry contract in connection with the erection of a lodge hall and store for the Independent Order of Oddfellows and E. H. Gregory, 127½ Windermere Road, has been let to Cross Bros., Victor Apartments, Aylmer Avenue, Windsor. Approximate cost of building, $30,000.

Yorkton, Sask.

The Provincial Department of Public Works, Regina, have let the contract for heating in connection with the addition to the Land Titles Office to Parrott & Byers, Yorkton.

Business Buildings and Industrial Plants

Buckingham, Que.

N. Cochrane, has commenced the erection of a business block at Main and St.

Joseph Streets, estimated to cost $4,000. Brick veneer construction.

Calgary, Alta.

Estimates are being prepared for finishing the office and store building being erected on Eighth Avenue W., for J. S. Mackie. Foundations, steel work, and concrete floors were completed two years ago by Jones & Lyttle, Bow River, and Sixth Street W.

Fort William, Ont.

J. C. Murray, Victoria Block, is considering the erection of stores, at an approximate cost of $7,000. Architect, F. Allen, c/o owner. Pressed brick construction, stone and concrete foundation, felt and gravel roofing.

Goderich, Ont.

Good progress is being made on the erection of a furniture factory for J. E. Baechler, Goderich Lumber & Milling Company. Owner is in the market for woodworking machinery, shafting and three-storey hoist.

Hamilton, Ont.

Plans have been drawn for a store and apartments to be built at 220 Wentworth Street S., by George F. Webb, 136 Stinson Street, at an approximate cost of $5,000. Brick construction, stone foundation, felt and gravel roofing.

Additions to the premises of Arcade, Limited, 43-51 James Street N., are contemplated. Architect, W. A. Edwards, Hamilton Provincial & Loan Building.

George Hill, 8 Stuart Street E., is contemplating the erection of an addition to the stable and storage building at 21-23 Vine Street. Steel, reinforced concrete and brick construction, felt and gravel roofing. Estimated cost, $5,000. Architect, F. J. Rastrick, 30 King Street E.

Hull, Que.

Work has been started on the erection of a moving picture theatre on Main St. for Joseph Paquin. Fireproof construction. Estimated cost, $15,000.

A moving picture theatre is being built on Main Street by T. & D. Paquin, 97 Frontenac Street. Work by day labor. Brick construction, shingle roofing. Estimated cost, $5,000.

E. Pelletier, Chelsea Road, is erecting a restaurant by day labor, estimated to cost $4,000.

J. Pharand, 85 Champlain Avenue, is about to erect a store by day labor. Brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,500.

Lindsay, Ont.

Horne Bros., William Street, are about to rebuild their plant, the Town having decided to guarantee their bonds to the extent of $65,000 for this purpose. Manager, A. Horne.

Mabee, Ont.

Joseph Stewardson is considering the erection of a general store, at an estimated cost of $7,000. Architect not yet appointed.

Montreal, Que.

Tenders on roofing and ornamental iron work required in the erection of stables for James M. Aird, 165 St. Urbain Street, are being received by Anglin's, Limited, 65 Victoria Street.

Morrin, Alta.

The erection of a flour mill is contemplated by Olsen & Johnson.

New Westminster, B.C.

In connection with the erection of an elevator and warehouse on Front Street for the Brackman-Kerr Milling Company, tenders on superstructure are being received by the Architects, Gardiner & Mercer, Trust Building. Material will include 400,000 feet of lumber.

Regina, Sask.

Plans are being prepared by J. E. Fortin, 10 Kerr Block, for a garage to be erected for the Roman Catholic Episcopal Corporation. Approximate cost, $8,000.

The erection of a theatre is being considered by the Orpheum Circuit, Fort Street, Winnipeg. Manager, E. J. Sullivan.

S. Jerome, Que.

Charlemagne Huot is about to erect a store and residence on St. Georges Street, at an estimated cost of $4,000. Brick construction, gravel roofing.

St. Thomas, Ont.

An office building will be erected this summer on Talbot Street for the Huron & Erie Loan Company, 442 Richmond Street.

Stratford, Ont.

The by-law to provide $25,000 for a site for the Bartlett Automobile Company, 1261 Queen Street W., Toronto, has been defeated.

Toronto, Ont.

Work has been started on alterations to the factory at 6 Macauley Avenue for A. A. Lind, 52 Boustead Avenue. Approximate cost, $3,500.

Work has been started by day labor on painting at the Union Station and repairs to the roof. Superintendent, J. J. Beck. Approximate cost, $20,000.

Plans have been drawn for an addition to the factory of the Dominion Wheel & Foundry Company, 131 Eastern Avenue. Proctically all material purchased. Approximate cost, $5,000.

R. C. Bustard, 146 Confederation Life Building, is erecting a factory on Vine Street, estimated to cost $3,500. Brick construction, felt and gravel roofing.

Vancouver, B.C.

The McLaughlin Motor Car Company, 1219 Georgia Street, propose to erect a reinforced concrete garage at Thurlow and Georgia Streets, at an estimated cost of $75,000. Local Manager, G. C. Coulson.

Vulcan, Alta.

The erection of an elevator, with a capacity of 30,000 bushels, is contemplated by A. Lee.

West Burnaby, B.C.

The erection of a store and garage on Kingsway is contemplated by F. W. Silver. Estimated cost, $5,000.

Windsor, Ont.

Plans are being prepared by T. Z. Humphries, McDougall Street, for a livery barn to be erected on Sandwich Street for H. J. Green, Cartier Place.

Wolfville, N.S.

The Wolfville Apple Company, Limited, are considering the erection of an aple house, at an estimated cost of $4,000. Frame construction, metal roofing.

Woodstock, Ont.

Tenders on the erection of a grandstand for the Agricultural Society will be received until June 24th at Molson's Bank, Dundas Street. Plans and specifications at the Bank.

CONTRACTS AWARDED

Guelph, Ont.

In connection with the telephone building being erected on Cork Street for the Bell Telephone Company, Montreal, the cut stone contract has been let to J. A. Rigg, Labelle Building, Windsor, the carpentry, steel, plastering, painting, and interior fittings contracts to Secord & Sons, Limited, Brantford, and the heating and plumbing contract to C. Taylor, 12 Dalhousie Street, Brantford. Electrical work will be done by owners. Contracts for roofing and galvanized iron not let.

Hamilton, Ont.

The contract for roofing in connection with the factory being built on Burlington Street by Practor & Gamble Company has been let to Thomas Irwin & Son, 22 McNab Street S. Previous report in error.

The contract for the erection of an extension to the Dominion Steel Foundry, Depew Street, has been awarded to Hancock Bros., 35 Locomotive Street. Reinforced concrete construction, concrete and brick foundation, felt and gravel roofing. Approximate cost, $4,000.

Kingston, Ont.

In connection with the locomotive shop which has been erected for the Canadian Locomotive Company, Limited, Ontario Street, the fan, heater coils and motor for the heating and ventilating equipment in the sheet iron and smith shop are being supplied by the B. F. Sturtevant Company of Canada, New Birks Building, Montreal.

Montreal, Que.

In connection with the erection of an addition to stores on St. Catherine Street for A. J. Higgins, St. Lawrence Hall, the general, carpentry, roofing, plastering, and painting contracts have been let to Xavier Parizeau, 312 Champlain Street, and the heating and plumbing contract to Whyte & Delaney, 51 City Councillors Street.

A. Piche, 496 Bloomfield Avenue, is building flats and stores on St. Lawrence Boulevard for J. U. Meunier, 107 St. James Street. Estimated cost, $6,000.

Ottawa, Ont.

In connection with the erection of stores and apartments on Elgin Street for S. W. Halliday, 20 Arlington Street, the plastering contract has been let to Brooks & Davis, Union Street, and the painting contract to the general contractor, A. C. Burton, 509 McLeod Street.

The contract for heating and plumbing in connection with the stores and apartments being built on Somerset Street by K. Cohen, 106 Sweetland Avenue, has been let to C. Wyman, 249 Creighton Street.

Owen Sound, Ont.

The contract for the erection of a hydro station and office for the Provincial Hydro-Electric Commission, Continental Life Building, Toronto, has been let to Grier & Lethbridge, Owen Sound.

Petawawa, Ont.

The general contract for the construction of frame testing houses for the Russian Government has been awarded to W. G. Adamson, 126 Sparks Street, Ottawa. Approximate cost, $18,000.

Quebec, Que.

J. B. Renaud & Company, 126 St. Paul

Street, have awarded the masonry contract for the erection of a warehouse to E. Cote, 360 Richelieu Street, and the carpentry contract to L. D. Vezina, 156 St. Patrick Street.

Toronto, Ont.

The contract for alterations to a restaurant at 83 Yonge Street for John Thompson, Limited, Chicago, Ill., has been let to Krahl Construction Company, Chicago, Ill. Smaller trades will be sublet. Approximate cost, $20,000. Rrchitects, Hands, Harris & Merritt, 7 King Street E.

The Board of Control have let the contract for flooring at the High Level Pumping Station to the Toms Contracting Company, 12 Rusholme Park Crescent, at $5,847.

J. H. Hill, 451 Grace Street, has let the contract for heating and plumbing in connection with the store and residence being erected at 832 Bloor Street to J. H. Wilson, 111 Robert Street, and the carpentry contract to A. H. Stewart.

Weston, Ont.

Work has been started on the erection of a store and apartments on Main Street for J. Nason. The masonry, concrete and carpentry contracts have been let to W. C. Gregory, Robert Street. Other trades not yet awarded. Approxiate cost, $4,000.

Residences

London, Ont.

H. A. Taylor, 140 Ridout Street, contemplates the erection of two residences, estimated to cost $5,500. Frame and white brick construction, concrete foundation, shingle roofing.

Maisonneuve, Que.

Work by day labor has been started on the erection of six flats for J. M. R. Coulombe, 120 Vennet Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $10,000.

Montreal, Que.

E. Genella, 2755 Verville Street, is building a residence, estimated to cost $3,000.

Leduc & Monpetit, 116 Rose de Lima Street, have commenced the erection of six flats. Estimated cost, $3,000.

Ovila Dubon, 218 Dufresne Street, is erecting three flats, at an estimated cost of $4,500.

Oakville, Ont.

Charles Carson is considering the erection of a residence to cost about $5,000.

Plans are being prepared by W. H. Hawkes for a residence to be built for Roland Hill. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

Work has been commenced on the erection of a dwelling on Reynolds Street by J. S. Marshall, Inglehart Avenue. Estimated cost, $5,000.

Ottawa, Ont.

John E. Wilson, 166 Kent Street, is considering the erection of a residence on St. Francis Street, at an estimated cost of $4,500. Brick veneer construction, stone foundation, shingle roofing.

Prices on painting, heating, plumbing and electrical work required in alterations to a residence on James Street for P. J. Powers, Wellington Street, are being received by F. C. Sullivan, Architect, Castle Building, Queen Street.

A residence is being built by day labor on Edgar Avenue for D. G. Boyd, 122 Spadina Avenue. Approximate cost, $3,000.

Albert Weekman, 1029 Carling Street, contemplates the erection of a brick veneer residence at a cost of about $3,800. Stone foundation, shingle roofing.

A residence will be built on Clemow Avenue for F. Beech by day labor. Architect, W. E. Noffke, Plaza Building, Rideau Street. Approximate cost, $16,000.

Work is about to start by day labor on the erection of a residence on Clemow Avenue for F. X. Plaunt, 333 McLaren Street. Brick construction. Estimated cost, $16,000.

The erection of a residence on Wendover Street is contemplated by Ira M. Bower, 133 Hopewell Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,500.

Outremont, Que.

The work required in the remodelling of a residence at 215 McDougall Street for J. A. Guimond, will be done by day labor. Architects, Aquin & Brault, 908 New Birks Building, Montreal. Brick construction. Estimated cost, $8,000.

Rupert, Que.

Work has been commenced on the erection of a summer bungalow for P. Leroux, Laval Street, Hul. Brick construction, concrete foundation, slate roofing. Approximate cost, $3,500.

Toronto, Ont.

A residence is being erected at 14 Wilfred Avenue by William Wilkie, 10 Wilfred Avenue. Smaller trades will be let. Brick construction, shingle roofing. Approximate cost, $4,000.

Work has been commenced on the erection of a residence on Normandy Boulevard for H. A. Johnston, 67 Belhaven Road. Brick construction, shingle roofing. Estimated cost, $3,000.

W. A. Taylor, 4 Laurier Avenue, will have plans drawn shortly for a residence to be erected on North Yonge Street, at an approximate cost of $4,000. Brick construction.

H. Davidovitch, 566 Dufferin Street, has commenced the erection of a residence, estimated to cost $6,000. Brick construction, shingle roofing.

Holmes & Anderson, 275 Jones Avenue, are building three residences on Langford Street, at an estimated cost of $5,000. Brick construction, shingle, felt and gravel roofing.

Plans have been prepared for a residence to be erected on Morrison Avenue by J. R. Joyce, 91 Royce Avenue, at an estimated cost of $3,000. Brick construction, shingle roofing.

W. A. Goy, 54 Harvie Avenue, has commenced the erection of a residence on Cloverdale Avenue by day labor. Brick construction, shingle roofing. Approximate cost, $3,000.

F. C. Lankin, 265 Fulton Avenue, has commenced the erection of a pair of residences at 10-12 Furness Avenue. Brick construction, shingle, felt and graver roofing. Estimated cost, $3,500.

Winnipeg, Man.

J. W. Parker, 473 Beresford Avenue, has commenced the erection of a residence on Rathgar Avenue, estimated to cost $3,000. Frame construction, stone foundation, shingle roofing.

Work has been started on the erection of a residence by N. Nelson, 31 Lipton Street. Frome construction, stone foundation, shingle roofing. Estimated cost, $3,100.

CONTRACTS AWARDED

Brantford, Ont.

The general contract for the erection of a residence at 161 Dufferin Street for E. B. Duncan, 104 William Street, has been awarded to Nathaniel Kews, 97 Erie Avenue, and the contract for heating, plumbing, and electrical work to Brantford Plumbing & Heating Company, 148 Dalhousie Street. Approximate cost, $6,500.

Charlottetown, P.E.I.

The general contract for the construction of a frame residence for W. H. Tidmarsh has been let to Major Schurman, Church Street, Summerside. Approximate cost, $6,000.

The congregation of St. James' Church have let the contract for remodelling the manse to Major Schurman, Church Street, Summerside. Estimated cost, $5,000.

Hamilton, Ont.

The contract for the erection of two residences at 359 McNab Street W. for J. Donohue, Wellington and Cannon Streets, has been awarded to Andrew Gow, 141 Young Street. Brick construction, stone foundation, shingle roofing. Approximate cost, $3,700.

In connection with alterations to a residence on Inglewood Drive for W. J Southam, Chedoke Avenue, the general, masonry, carpentry, and roofing contracts have been awarded to Gummo & Donaldson, 15 Tuckett Street.

E. Dempster, City Hall, has let the general, masonry, carpentry, and roofing contracts for the erection of a residence to F. D. Barnes, 90 Jackson Street W., and the heating and plumbing contracts to H. Barnes, 93 Clyde Street. Plastering and electrical work not let. Approximate cost, $4,000.

Crompton & Crompton, Bank of Hamilton Building, have let the sub-contract for plastering in connection with the erection of three residences to H. Hancox, 41 Robins Avenue, the painting contract to R. Petch, 11 Argyle Avenue, the contract for plumbing to E. E. Covell, 264 Ottawa Street, and for electrical work to H. Gretton, 49 Robins Avenue.

Hamiota, Man.

The masonry and carpentry contracts for the erection of a farm residence for Arthur Atkinson, c/o R. L. Smith, Architect, 301 Boyd Building, Winnipeg, have been let to A. Bostrom, 255 Pritchard Avenue, Winnipeg. Estimated cost, $9,500.

Kingston, Ont.

The general contract for the erection of three bungalows for H. F. Norman, Patrick and Charles Streets, has been awarded to the Kingston Cement Products, 66 Charles Street. Cement block construction. Approximate cost, $4,000.

Byron Derbyshire, 163 Union Street, has let the contract for the construction of three bungalows to the Kingston Cement Products, 66 Charles Street. Cement block construction. Estimated cost, $4,200.

Work has been started by W. H. Gordon, 12 Nelson Street, on the erection of a residence on Albert Street, estimated to cost $9,000. Architects, W. Newlands & Son, 258 Bagot Street.

Lansdowne, Ont.

The contract for the erection of a concrete and brick residence for A. W. Burtch has been let to A. Sherman. Approximate cost, $4,000.

Lunenburg, N.S.

Russel Webb has let the general contract for the erection of a frame and concrete residence to Frank A. Young, Pelham Street.

Montreal, Que.

Work has been started on the erection of a residence for J. A. Dionne, 581 St. Catherine Street W., by Savage & Lecacq, 213 St. Ferdinand Street. Brick construction, concrete foundation, felt and gravel roofing.

J. P. Tremblay, 291 Prudhomme Avenue, has let the roofing contract in connection with the erection of two flats on Old Orchard Street to A. C. St. Amour, 28 Botrel Street, the plastering contract to A. Dutrisac, 133 Sir George E. Cartier Street, the contract for heating and plumbing to E. & H. Madore, 2560 Notre Dame St. W., and for electrical work to Vallee & Hamilin, 1867 St. James Street.

North Bay, Ont.

The contract for heating and plumbing in connection with the residence being erected on Main Street W., for D. A. Campbell, Campbell Block, has been awarded to S. J. Cherry, 109 Main Street W.

Oakville, Ont.

Work has been commenced on the erection of a dwelling for L. Wright, Manager of the Aluminum Works, by E. Burrell, Reynolds Street. Brick veneer construction, concrete foundation, shinge roofing. Approximate cost, $4,000.

Orillia, Que.

E. Webb & Sons, 75 Mississaga Street E., are building a residence, estimated to cost $4,500. The contract for carpentry work and material for interior trim has been let to J. A. Orton, Front Street.

Ottawa, Ont.

The masonry and carpentry work in connection with alterations to a residence on James Street for P. J. Powers, 432 Wellington Street, will be done by the general contractor, A. Boehmer, 380 Creighton Street.

G. Clark, 852 Somerset Street, has let the contract for heating and plumbing in connection with the erection of a residence to J. Montgomery, 166 Centre Street. Owner will do electrical work.

The contract for heating and plumbing in connection with the residence being erected on Fifth Avenue by W. H. Craig, 136 Bank Street, has been let to T. Watters, 288 Booth Street, and the electrical contract to Rideau Electric Supplies, 128 Bank Street.

Leon Petegorsky, 87 Goulbourne Avenue, has let the contract for plumbing in connection with the apartments being erected at Laurier and Chapel Streets to Godfrey & Chapman, 348 Rideau Street.

In connection with the residence being built by J. P. Yandon, 180 Hopewell Avenue, the electrical contract has been awarded to S. Andrews, 13 Armstrong Street

V. V. Rogers, Limited, Sparks Street, have let the contract for heating and plumbing in connection with the erection of a residence on Fairmont Street to Thomas Watters, 288 Booth Street, and the electrical contract to Rideau Electric Supplies, 128 Bank Street.

The plastering and painting contracts in connection with alterations and additions to apartments on Frank Street for F. Argue have been let to the general contractors, Alexander & Campbell, 245 Bank Street.

The contract for the erection of a brick veneer residence on Butternut Street for Mrs. M. Dunning has been let to R. W. Dunning, 295 Creighton Street. Stone foundation, shingle roofing. Approximate cost, $5,000.

In connection with the residence being erected on Bellwood Street for the Oakland Land Company, 58 Sparks Street, the plastering contract has been awarded to T. Patterson, 70 Rosedale Street, the heating contract to Pease Foundry Company,, Limited, 287 Lyon Street, the contract for plumbing to J. P. Baird & Company, 775 Bank Street, and for electrical work to Dominion Electric Company, 417 Sparks Street.

The brickwork contract in connection with alterations and additions to apartments on Somerset Street for C. D. Joyce, 1102 Somerset Street, has been let to J. Copeland, 19 Laurel A Street, the contract for supply of lumber to McAuliffe Davis Company, Duke Street, and for tiles to Shaver & Beattie, Booth Building.

Sandwich East Township, Ont.

T. C. Ray, Royal Bank Building, Windsor, has let the following contracts for the erection of a residence:—masonry, A. Sefton, 71 Howard Street; carpentry and roofing, Ward Bros., 242 Dougal St.; plastering, F. Troup, Victoria Road, Walkerville; painting, Summers & Langlots, care of owner; heating and plumbing, T. Blackburn, 54 Pitt St. E.; electrical work, A. Cook, 103½ Albert Street.

Toronto, Ont.

M. Peters, 617 Queen Street W., has let the general contract for the erection of a residence at Lippincott and Herrick Streets to A. F. Foster, 960 St. Clair Avenue W. Approximate cost, $4,000.

Westmount, Que.

The contract for the erection of an addition to the residence of M. J. Stack, 4824 Western Avenue, has been awarded to G. E. Blackwell, 4184 St. Catherine Street. Approximate cost, $4,500.

W. Dalton, 577 Lansdowne Avenue, has let the general contract for the erection of a residence on Willow Avenue to Anglin's, Limited, 65 Victoria Street, Montreal. Work has been started. Approximate cost, $6,800.

Windsor, Ont.

The masonry contract in connection with the erection of a residence for C. & M. Glendon, Ouellette Avenue, has been let to G. Sewell, 219 Ouellette Ave., the carpentry, roofing, plastering, painting and electrical contracts to W. Hedrick, and the contract for heating and plumbing to Windsor Hardware Company, 7- Sandwich Street.

The masonry contract for the erection of a residence on Wyandotte Street for Alexander Campbell has been let to H. W. Wilson, the carpentry and roofing contract to Fred Jacques, 160 Dougall Avenue, the plastering contract to O. Lockwood, 158 Goyeau Street, the contract for painting to Lossing & Harris, 100 Church Street, the heating and plumbing contract to J. L. Heureux, and the electrical contract to G. Campeau, 121 Tuscarora Street.

The general contract for the construction of a residence on Caron Avenue for E. G. Milligan, Heintzman Building, has been transferred to T. I. Brush, 32 Moy Avenue. Approximate cost, $5,000.

Work has been commenced on the erection of a double residence on Caron Avenue for E. G. Milligan, Heintzman Building. The sub-contract for heating and plumbing has been let to Windsor Hardware Company, 71 Sandwich Street E. Masonry, carpentry, roofing, plastering, and painting will be done by the general contractor, T. S. Brush, 32 Moy Avenue.

Work has been started on the erection of five residences on Pelissier Street for Albert Little, 201 Goyeau Street, by L. D. Galloway, Victoria Road, Walkerville. Plans are being prepared for three additional residences. Frame and brick veneer construction, concrete foundation, shingle roofing. Estimated cost, $3,200 to $4,500.

Power Plants, Electricity and Telephones

Ailsa Craig, Ont.

The Town Council are considering the installation of a power distribution and lighting system. Cerk, J. S. Smith.

Beaverdale, Sask.

Tenders will be received until noon, July 10th, by A. L. Ashdown, Secretary to the Creekside Rural Telephone Company, Limited, for (1) construction of the Company's system, including material and labor, and (2) labor only. Plans and specifications at the Department of Telephones, Regina, and at office of the Secretary.

Dewar Lake, Sask.

Tenders will be received until July 15th by S. Finley, Secretary to the Flaxcombe North Rural Telephone Company, for (1) all labor and material required in the construction of the Company's system, and (2) labor only. Plans and specifications at office of the Department of Telephones, Regina, and with the Secretary.

Toronto, Ont.

The Parks Committee have recommended the installation of an ornamental lighting system on University Avenue, at an estimated cost of $10,000. Underground system.

Widdifield Township, Ont.

The Municipal Commissioners are in the market for material necessary for the construction of a telephone system. Secretary, J. A. Carmichael, North Bay.

CONTRACTS AWARDED

Forget, Sask.

The contract for the North Forget Rural Telephoen Company's system has been let to W. D. Craig, Princess Theatre Block, Regina. Estimated cost, $7,000.

Winnipeg, Man.

The Board of Control have let the contract for the supply of a motor generator exciter set to Vickers, Limited, 20 Bleury Street, Montreal, at $5,400.

Tenders and For Sale Department

Tenders for Foundations

Tenders will be received by registered post only up to noon **Tuesday, July 6, 1915**, for constructing foundations for incinerating plant on Don Roadway.

Tenders must be addressed to the Chairman, Board of Control, City Hall, and be plainly marked on outside of envelopes, "Tender for Foundations, Refuse Incinerating Plant." Specifications and form of tender may be obtained at Street Commissioner's Office. Parties tendering must comply strictly with conditions of City By-law as to deposit and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.

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Tenders for Construction of Bridges

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Tuesday, July 20th, 1915**, for the construction of:

1. Reinforced Concrete Slab Culvert of 12 ft. span, between North Guillimbury and Whitchurch Townships, Con. VI., in the County of **York.**
2. Reinforced Concrete Slab Culvert of 12 ft. span, between North Guillimbury and Whitchurch Townships, between Con. VIII. and IX. East, in the County of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
County Engineer.

Toronto, June 29th, 1915. 26

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Incandescent Lamps, Public Buildings, Ottawa, Ont., will be received at this office until 4 p.m., on **Tuesday, July 13, 1915**, for the work mentioned.

Tenders will not be considered unless made upon forms supplied by Department and in accordance with conditions contained therein.

Specifications to be seen on application to Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Toronto, to Mr. R. L. Deschamps, Overseer, Dom. Bldgs., Montreal, and to the Chief Architect, Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender.

By order,

R. C. Desrochers,
Secretary.

Department of Public Works,
—81952. Ottawa, June 28, 1915. 26

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Tuesday, July 13th, 1915

For All Trades

Enlargement McMurrich School

(Ossington Avenue near St. Clair)

also

Midsummer Repairs

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by surety companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall **not later than 2 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

MILES VOKES,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer.

26

FOR SALE

Stone Quarry and Gravel Pit—30 acres finest limestone, three acres gravel; forty-five miles from Toronto; adjacent to railway; price ten thousand; would consider revenue-producing property for part. Box 218, Contract Record, Toronto, 26

FOR SALE

Complete shop outfit, consisting of:—
One 10 x 15 Iron Shaper;
One Pedestal Emery Stand;
One 20-in. Square Base Champion Drill;
One 14 x 28 Fay & Scott extension gap lathe;
One 8 H.P. Gasoline Engine;
Together with belting, shafting, hangers, and pulleys.

This machinery in first-class condition. Box 213, Contract Record, Toronto. 25-27

SALESMAN WANTED

with connection among architects; state experience and give references. Box 217, Contract Record & Engineering Review, Toronto, Ont. 26

CITY ENGINEER

Applications marked "Application for Engineer" will be received by the undersigned up to noon, **Friday, July 2nd, 1915**, for the office of City Engineer for the city of Guelph. Applicants to state qualifications and experience, and give references.

T. J. MOORE,
City Clerk.

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Fires

Kentville, N.S.

The Arena, belonging to the Kentville Arena Company, has been destroyed by fire, causing a loss of $10,000. President, T. P. Calkin.

Maple Green, N.B.

The residence of William LeBlanc, Postmaster, has been completely destroyed by fire.

Minerve, Que.

A store and residence belonging to J. L. Letourneau and the residence of H. Letourneau have been completely destroyed by fire. Loss, $12,000, partially insured.

Late News Items

Arrow River, Man.

Tenders on the erection of a school will be received until noon, July 2nd, by J. R. Lynch. Plans and specifications with Mr. Lynch.

Forget, Sask.

C. M. Force, Secretary to the Protestant School District No. 1, will receive tenders until 9 p.m., July 3rd, for the construction of a school house. Plans and specifications with Secretary.

Guelph, Ont.

The City Council will receive tenders until July 6th for laying 5,500 feet of conduit pipe and for the construction of a reinforced concrete reservoir, with a capacity of 500,000 gallons. Plans and specifications at office of the Water Commissioners, City Hall.

Lachine, Que.

Tenders will be received until 5 p.m., July 2nd, by the City Clerk, for the supply of cast iron water pipe, specials, sewer pipe, valves and valve boxes, hydrants, stone, river sand and cement. Specifications at office of the Engineer, V. H. Dupont.

Lanigan, Sask.

Tenders on the construction of a telephone system for the Tipperary Rural Telephone Company will be received until noon, July 5th, by the Secretary, E. G. Fisher. Plans and specifications with the Secretary and at the Department of Telephones, Regina.

St. Francois Xavier, Man.

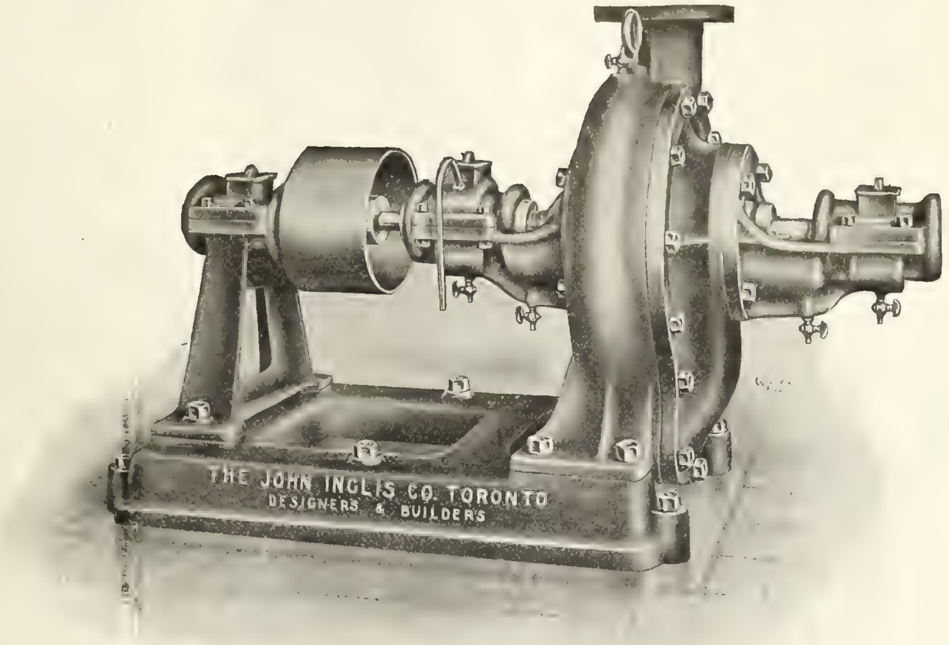
Tenders will be received until July 6th by R. J. McBeath, Municipal Secretary, for the construction of a reinforced concrete bridge on wooden piling. Plans and specifications with the Highway Commissioner, Provincial Government, Winnipeg.

Toronto, Ont.

Caplan Bros. and Layevsky, 237 Augusta Avenue, are receiving tenders on slate roofing and electric wiring required in the erection of ten residences.

The Board of Control will receive tenders until July 6th on the construction of foundations for the Don Roadway Refuse Incinerator Plant. Plans at office of the Street Commissioner, City Hall.

PUMPS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Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

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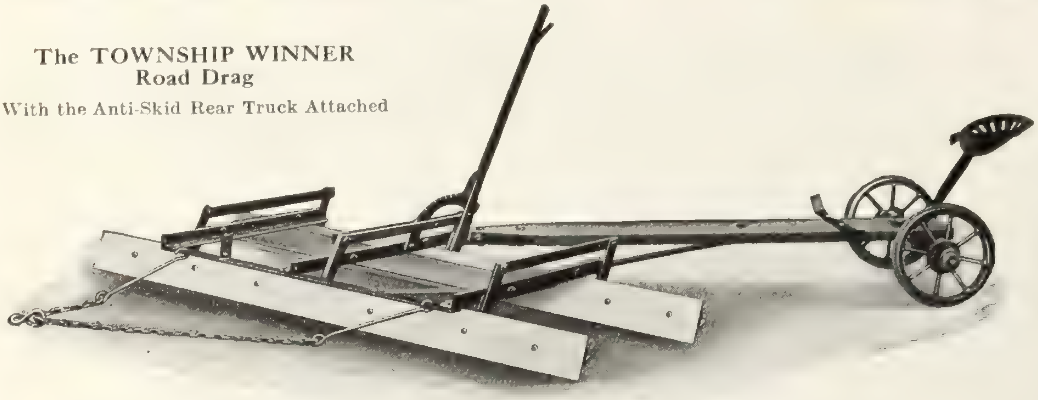

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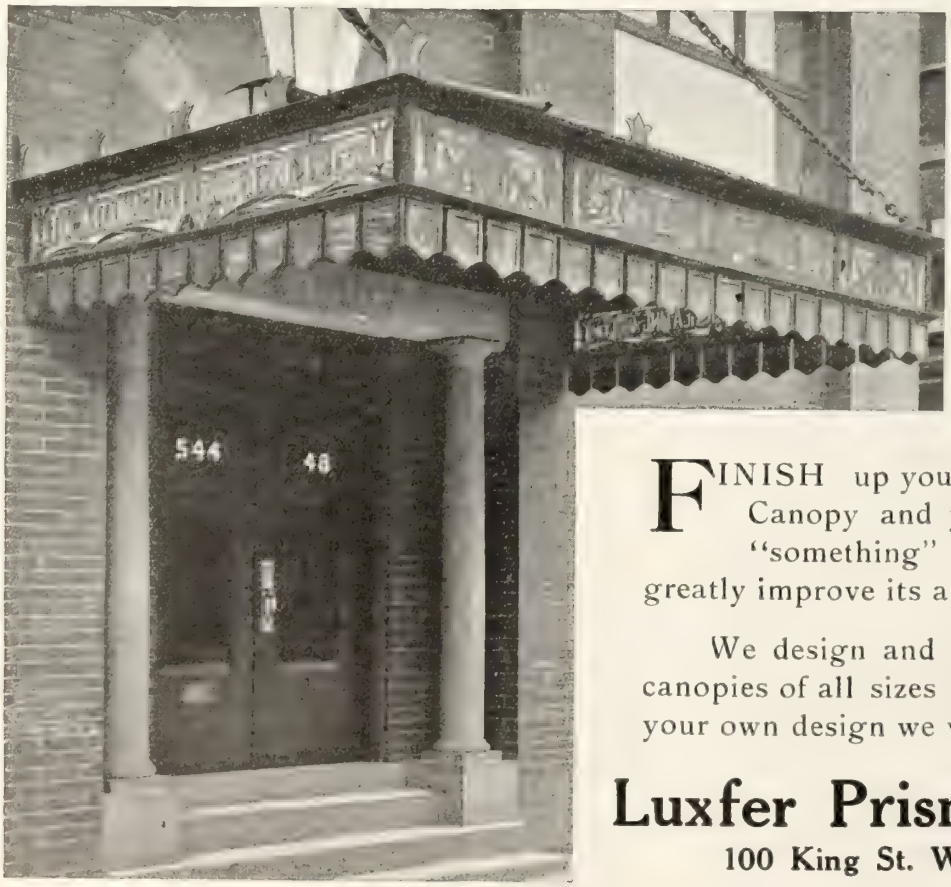

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Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

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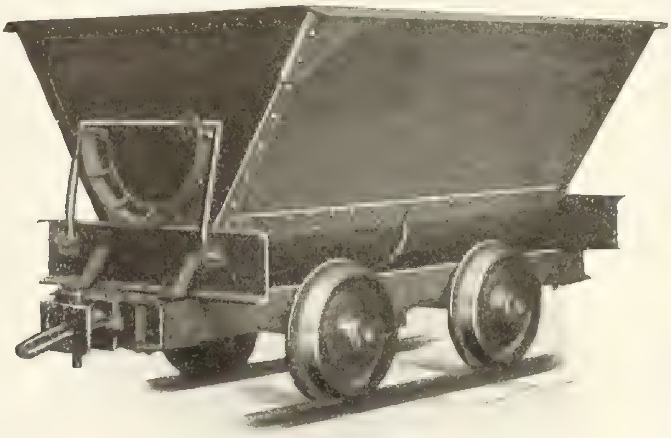

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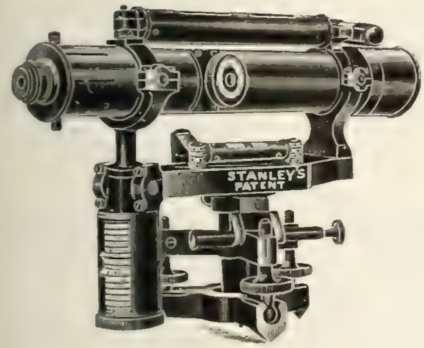

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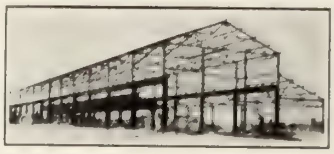

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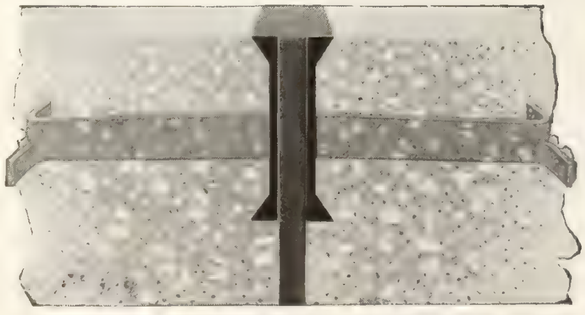
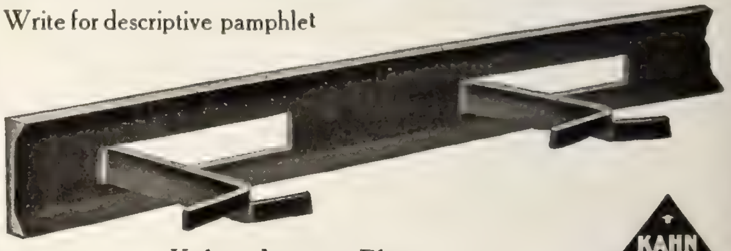


Cross-sectional view showing joint protected by Kahn Armor Plates with filler between them.



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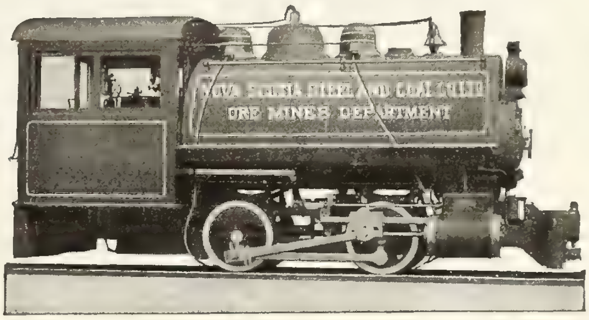

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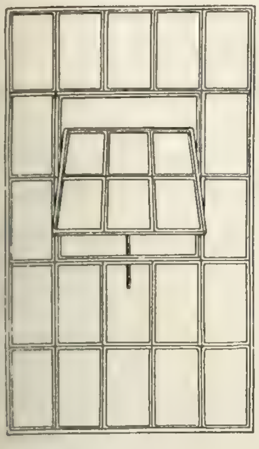

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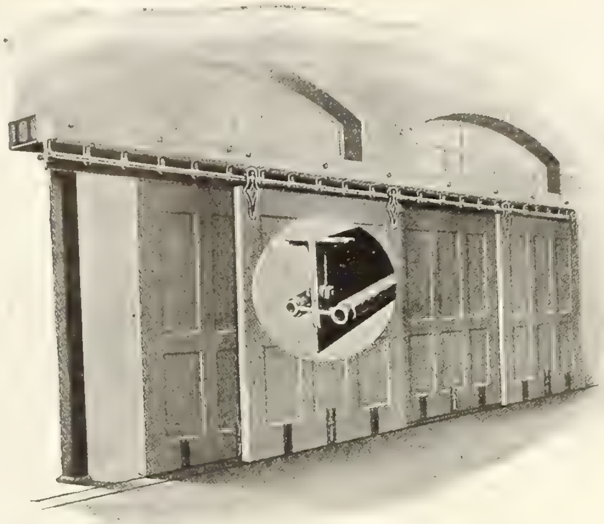

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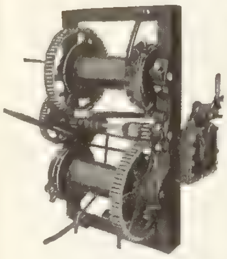
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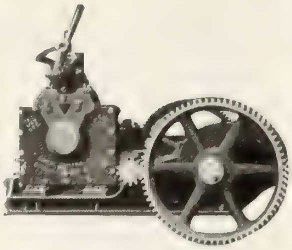
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NEW YORK CITY

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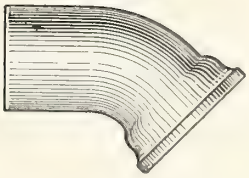

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Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.75; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. net cash. Copper bearing sheets—Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.00, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.00. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manila, 16c basis per pound; British manilla, 13½c basis; African hemp, 13½c; sisal rope, 10½c basis; lath yarn, 9¼c. Boiled linseed oil—in barrels, 80c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20. Bags 10 cents extra.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $11.50 per 100 lbs.; boiled linseed oil, in bbls., 98 cents per gal.; raw linseed oil, in bbls., 95 cents per gal.; dry red lead, $10.00 per 100 lbs.; putty in bulk, $3.25 per bbl.; putty in 25-lb. tins, $3.75; turpentine, in bbls., 80 cents per gal. Mixed paint, ordinary colors, per gal., $3.10.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 350 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35 in car lots, $40 in warehouse; fire clay, $12 per ton in car lots.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galavanized iron—28 gauge, $5.75 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in, $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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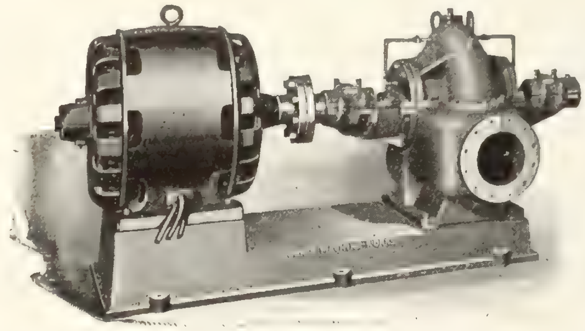

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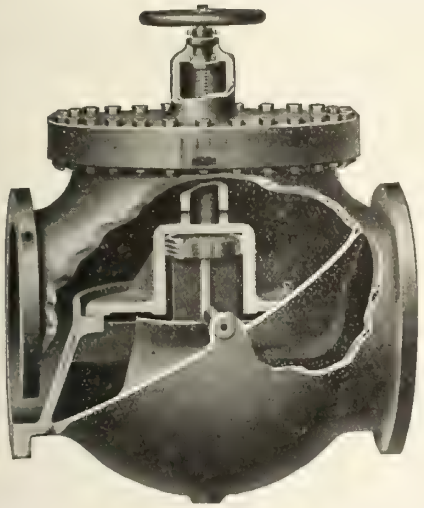

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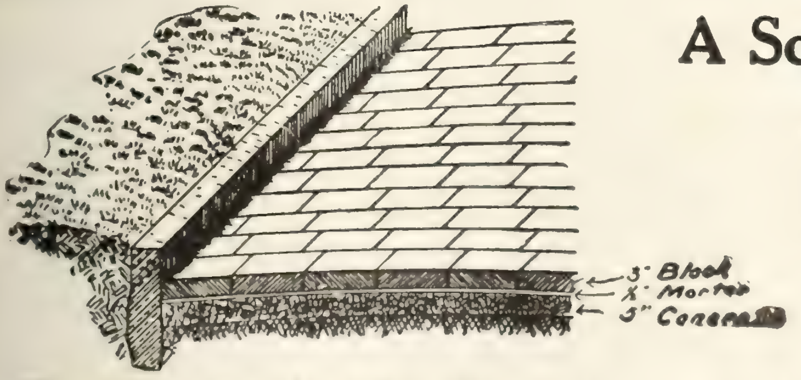

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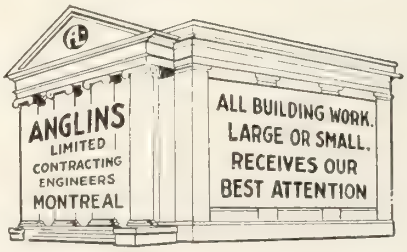
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Steelcrete Concrete Reinforcing
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Crushed Stone
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Cement Testing and Reinforced Concrete Inspection.

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Expert Examinations & Reports.

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Estimates furnished on application.

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Hemispherical and Segmental Bottoms

Manufactured at Pittsburgh, Pa.

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OUR NEW OFFICE AND WORKS: 1139 SHAW STREET
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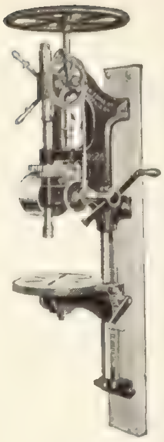

Accurate and Efficient Drilling is assured when you use

Canadian Long-Service Drills

Made in Canada by expert mechanics, working with highly specialized machinery, Canadian Tools offer you your money's worth every time.

We manufacture a complete line of Forges, Blowers, Drills, Fans, Disk Wheels, Mill Exhausters, Punches, Shears, Pumps, Engines, Etc.

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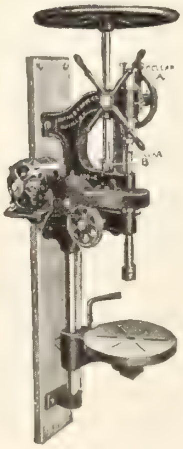

The red brick de luxe, demanded all over North America, where quality is the first consideration.

"PRESSED BRADFORD BRICK"
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are made of the famous Bradford red shale—the ideal brick-making material.

They have sterling merit combined with distinctive color.

"BRADFORD REDS" — We specialize on one color, red. "BRADFORD REDS" are our smooth brick, made in both dry-pressed and impervious.

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Bradford Pressed Brick Co.
"The Red Brick People"
Bradford, Pa.

We also make fire-proofing Hollow Brick and Hollow Block.

BUFFS

We are in a position to supply buff pressed brick of a most attractive and uniform colour.

Superior Quality *Prompt Service*

Interprovincial Brick Co. of Canada Limited

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Made in Canada

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(Galvanized)

AND

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(Enamelled)

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Orpen Conduit Company, Limited
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This Illustration Shows

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Which Differs from Old Style Wire Rope
Because

Each Strand is separately served with Fibrous Material

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Stocks carried in
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Dominion Wire Rope Co., Ltd.
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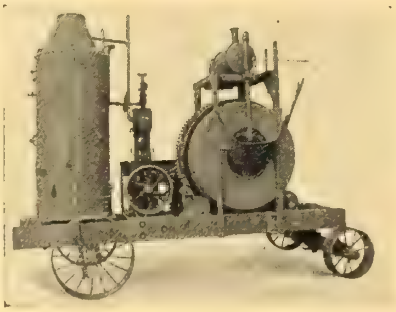
"Ransome"

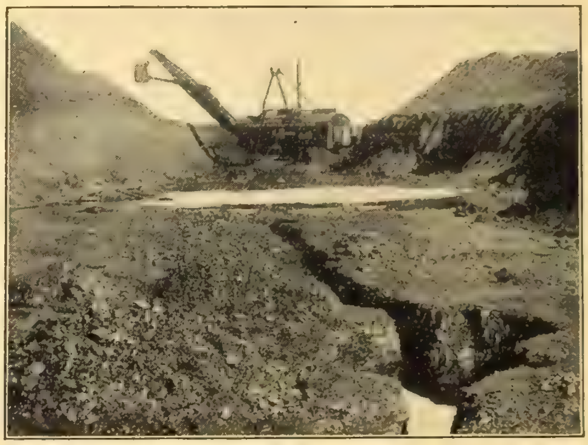
Concrete Mixers



When deciding upon a special concrete plant, let us quote you for a mixer that will fulfil all your needs.

"Marion"

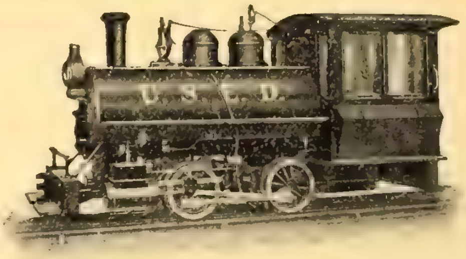
Steam Shovels



We supply "Marion" Shovels, Drag Line Excavators, Railroad Ditchers and Dredges in all sizes and styles—for all classes of work.

"Davenport"

Locomotives



When you want a satisfactory locomotive, let us quote you and send specification—prompt shipment.

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Branches:—St. Catharines, Ont.
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Vol. 29 Toronto, July 7, 1915 No. 27

Contract Record and Engineering Review

ESTABLISHED 1886

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BENT GLASS
THE TORONTO PLATE GLASS IMPORTING CO. LIMITED.
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GLASS BENDERS
TO THE TRADE

THE TORONTO PLATE GLASS
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GLASS IMPORTERS AND MANUFACTURERS
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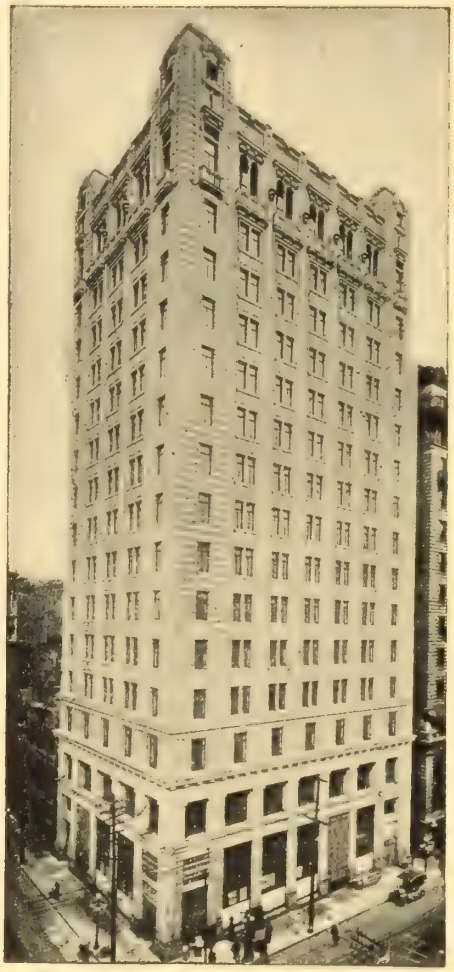
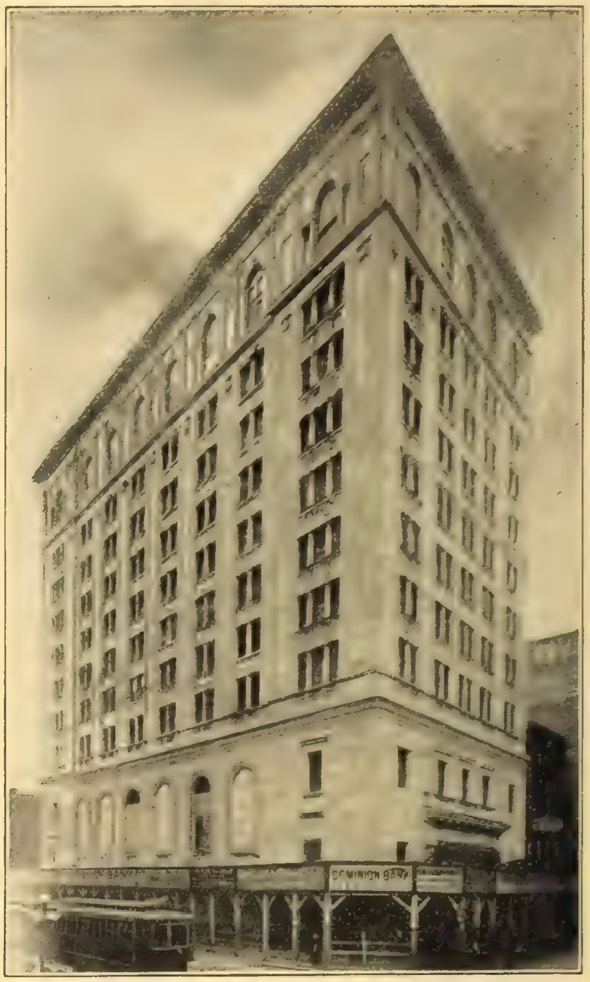
THE NORTHWESTERN TERRA COTTA COMPANY



C. P. R. OFFICE BUILDING
Darling & Pearson, Architects



DOMINION BANK BUILDING
Darling & Pearson, Architects

Two prominent corners in Toronto

The Terra Cotta for both buildings was manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

Chicago - Illinois

Agencies in all the large cities of Canada.

28 "Service" Branches
Throughout Canada

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Rubber Company, Limited
Montreal, P. Q.

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When you find a physician "taking his own medicine," you can usually rely on his diagnosis.

Of the thousand-and-one articles of rubber which we manufacture, practically all are used by us in our own offices, in our own factories, or in our own homes.

WE TAKE OUR OWN MEDICINE

Our line-up is complete, our quality is unexcelled and our prices are right. Let us show you what we can do.

It is our desire to serve you.

Canadian Consolidated
Rubber Company, Limited
Montreal, P. Q.

28 "Service" Branches
Throughout Canada

To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

from

Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.

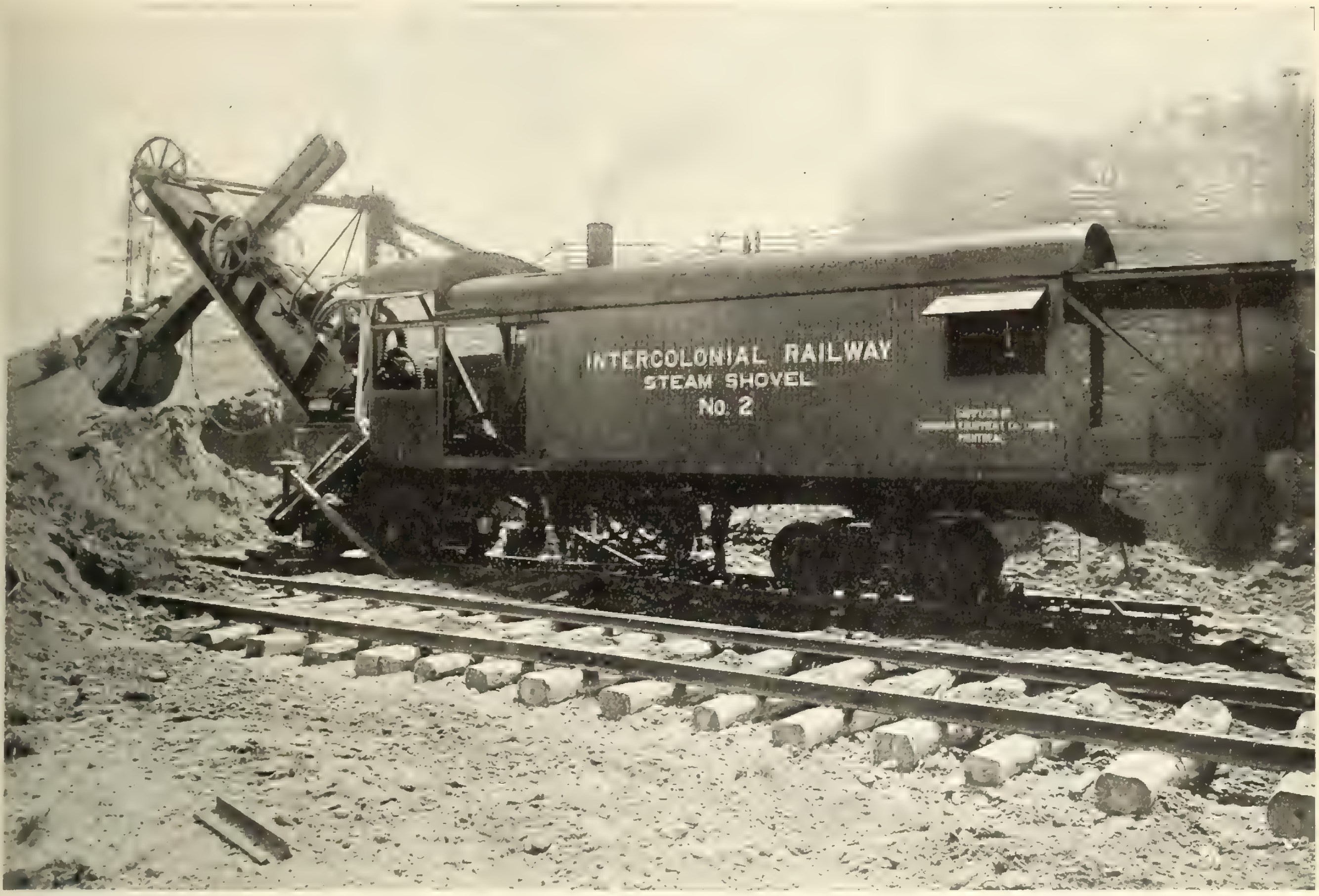
Builder's Paints and Supplies

We make a specialty of paints and painting supplies for builders and dealers in paint supplies. "Lion Brand" white lead and dry colors are known and specified by architects everywhere for their uniformly good quality. "Lion Brand" goods also include flat brick paint, pure colors in oil, etc.

GET OUR PRICES

The Ottawa Paint Works
Ottawa, Ont.

The Atlantic Type Shovel is the Fastest in the World



The ATLANTIC class 45-16-2½ type shovel shown above was recently sold to the Intercolonial Railway, and is working near Moncton, N. B. If interested write us regarding these shovels. Immediate shipment can be made as we have shovels in stock at Montreal.

If in the market for Dump Cars, Flat Cars, Passenger Coaches, Locomotives, Locomotive Cranes, in fact any kind of contractors' or railway equipment, write us for bulletins, photos, specifications and prices.

CANADIAN EQUIPMENT CO., LIMITED
Branch: ST. CATHARINES, ONT. MONTREAL

Western Representatives:

Dominion Equipment & Supply Co., Limited
WINNIPEG VANCOUVER

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Aikenhead Architectural Iron Works
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McGregor & McIntyre
Steel & Radiation Limited

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Turbine Equipment Company

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Inglis Company, John
Marsh & Henthorn
McDougall Caledonian Iron Wks.

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Bradford Pressed Brick Co.
Hydraulic Press Brick Co
Interprovincial Brick Co.
North-Western Terra Cotta Co.

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Hopkins & Co., F. H.
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Sudbury Construction & Machinery Company

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Crossley Machine Company
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DesMoines Bridge & Iron Co.
Dickson Bridge Works
Dominion Bridge Company
Hamilton Bridge Works Co.
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Manitoba Bridge & Iron Works
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Aikenhead Hardware Limited

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Trussed Concrete Steel Co.

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Cast Stone Block & Machine Co.

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Interprovincial Brick Co.
Morrison & Co., T. A.
Rogers Supply Company

Cement Guns
Cement Gun Company

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Ceresit Waterproofing Co.

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E. Laurie Company
Turbine Equipment Company

Ceresitol
Ceresit Waterproofing Co.

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Conduits Co., Ltd.
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Marsh & Henthorn, Limited
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Can. Consolidated Rubber Co.

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Browning Company
Canadian Equipment Company
Hopkins & Co., F. H.

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Tiffin Wagon Co.
Watson Wagon Co.

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Marsh & Henthorn
National Steel Car Company
Sheldons Limited

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Can. Consolidated Rubber Co.

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Sturtevant Co. of Can., Ltd., B. F.

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Hopkins & Co., F. H.
Pawling & Harnischfeger

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Sheldons Limited

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Laurie & Lamb
McDougall Caledonian Iron Wks
Rock & Power Machinery Co.

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Chipman & Power
Dominion Engineering & Inspection Company
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Galt Engineering Co., John
R. S. & W. S. Lea.
McDougall, Geo. K.

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Trussed Concrete Steel Co.

Fans
Sheldons Limited
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Can. Consolidated Rubber Co.

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verMehr Engineering Co., John

Fireproof Doors and Windows
Hope & Sons, Henry
Ormsby Company, A. B.
Pedlar People Limited
Steel & Radiation Limited
Trussed Concrete Steel Co.

(Continued on page 12)

Making Tall Stacks Safe at Lowest Cost

When the original stack of the Torresdale Pumping Station, Philadelphia, was condemned, it was decided to put the newer and heavier chimney on Simplex Concrete Piles. The soil here is a cinder and loose gravel fill over river mud, with a layer of coarse gravel overlying solid rock. Simplex Piles were driven 25 ft. to rock, and the 252 ft. stack is permanent.

Simplex Piling is particularly adapted to work of this nature, where absolute freedom from settlement is essential It goes down to firm footing on solid rock or hardpan—no matter how tough is the driving through the top soil.

SIMPLEX Concrete Piling

The Simplex method is not new—it is proven by time and the fact that **two-thirds of the made-in-place concrete piles in the world are Simplex.**

Simplex affords safety first—a foundation that never subsides. It is the same as carrying your footing course right down to solid rock.

It affords quick work. The heavy, straight, smooth driving form goes down quickly. Hard driving doesn't "hang it up."

The greater bearing strength of Simplex affords great economy in design. Less piles are needed.

Simplex Concrete Piling Company of Philadelphia

Canadian Representatives

Simplex Construction Company, Limited

Coristine Building, MONTREAL

"Simplex Piles Drive to Firm Footing"

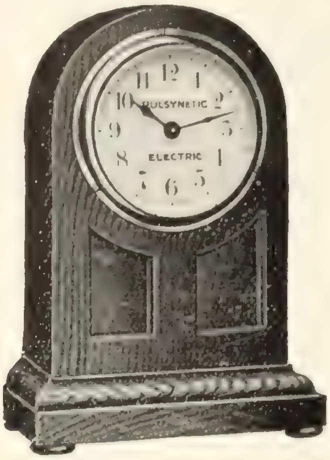

Fig. C 21. Mantel Clock

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as well as accuracy in Time-keeping is embodied in all Pulsynetic Electric Clocks. No matter whether they are to be fixed in the Residence, Office, Factory, Warehouse, or Tower, we have the correct design at the right price.

One master transmitter controls any number of dials, irrespective of size or position and never wants winding.

Architects, Engineers and all interested in Correct Time should send at once for our Book Five, or full particulars and prices may be obtained from:—

W. Ashall
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TORONTO

Gent & Co., Ltd.
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Cables, Lodestone

KERR
Gate Valves
and
Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

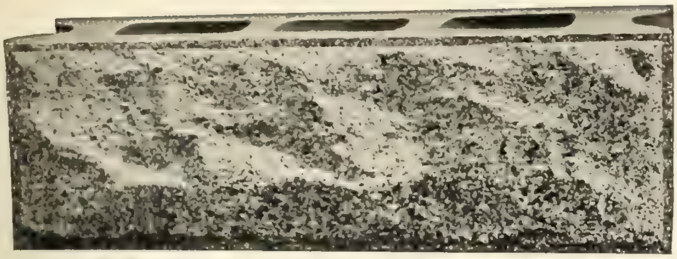
Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO



8 x 8 x 24 inch Granite Rock Face Block

Molds for Casting

Waterproof Hollow Cement Building Blocks

With Granite Faces

THEY COST LESS — THEY SELL FOR MORE

YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.

8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited **(Zagelmeyer System)**

298 Howard Avenue, WINDSOR, ONTARIO

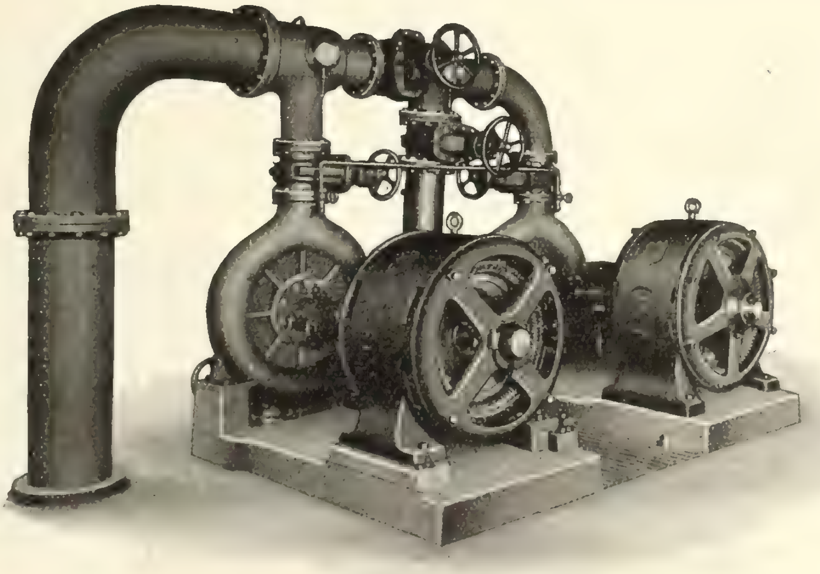
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Aikenhead's

Spiedel Chain Hoist

Fig. 1
Hoist showing lower block in position for regular or slow speed.

One man with an eight-ton hoist can lift 16,000 lbs.

These hoists are best from the standpoint of efficiency, speed and price.

When used to only half capacity, speed is doubled by locking one of the lift chains.

Made in various sizes, with safe working capacity of 1,000 to 40,000 lbs.

Store open Saturdays till 5 p.m. other days till 6 p.m.

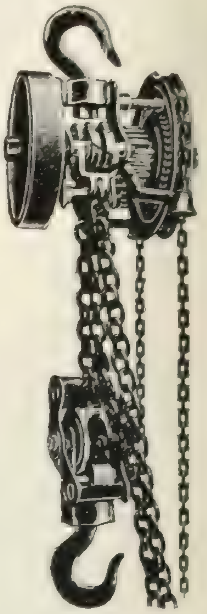


Fig. 2
Hoist showing lower block in position for fast speed.

Aikenhead Hardware Limited
17 Temperance St., TORONTO, Can.

"QUALITY FIRST"

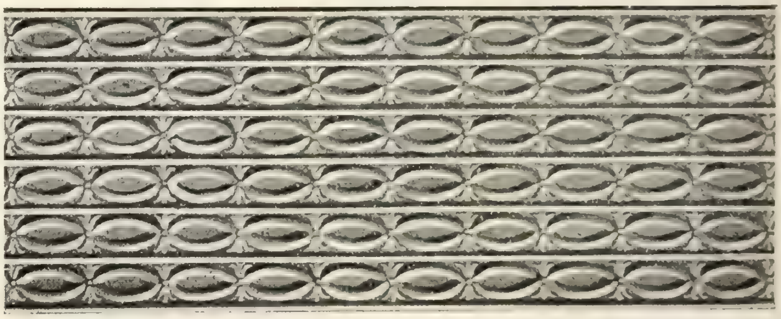
SARNIA M.P.Co.

Made in Canada

SARNIA STEEL CEILINGS

Metal ceilings and walls are particularly adaptable for use in stores, apartment houses, basements, school houses, etc., on account of its protection from fire and permanent finish.

Illustrated below is our Dublin Scroll design in walls, ceiling and cornice.



KILLERS CONTINUOUS HIP SHINGLES

We manufacture a complete line of Plain Galvanized Iron, Corrugated Iron, Metal Shingles, Ventilators, Sky Lights, Eave Trough, Volleys, Conductor Pipe, etc.

Write for descriptive literature and stock price lists.

SARNIA METAL PRODUCTS CO., Limited
SARNIA, ONTARIO

Paint Your Cement Floors!

Are they **Dusting, Rotting, Crumbling** for want of a preservative filler? Are fine particles of sand and cement flying through the air and ruining machinery bearings and electrical connections? Are oils, greases and water soaking into the surface?

Toch Brothers'
Cement Filler and Cement Floor Paint

will prevent this, and give your floors that smooth, hard, metallic surface that resists wear and is water-oil-grease and dust-proof. There need be no dusting and disintegration of floors, and consequent damage to machinery, and no rotting of concrete by oil and grease drippings from machinery and motors. Why should you not double the life of your floors and keep them always fresh and clean in appearance when the cost is so small?

Steel need not rust!

Wood need not rot! Nor concrete "Dust"!

Write to nearest distributor for copy of illustrated booklet and color card.

"MADE IN CANADA" BY

"R. I. W." DAMP-RESISTING PAINT CO. 202 Mail Bldg., TORONTO
Factory, Oakville, Ont.

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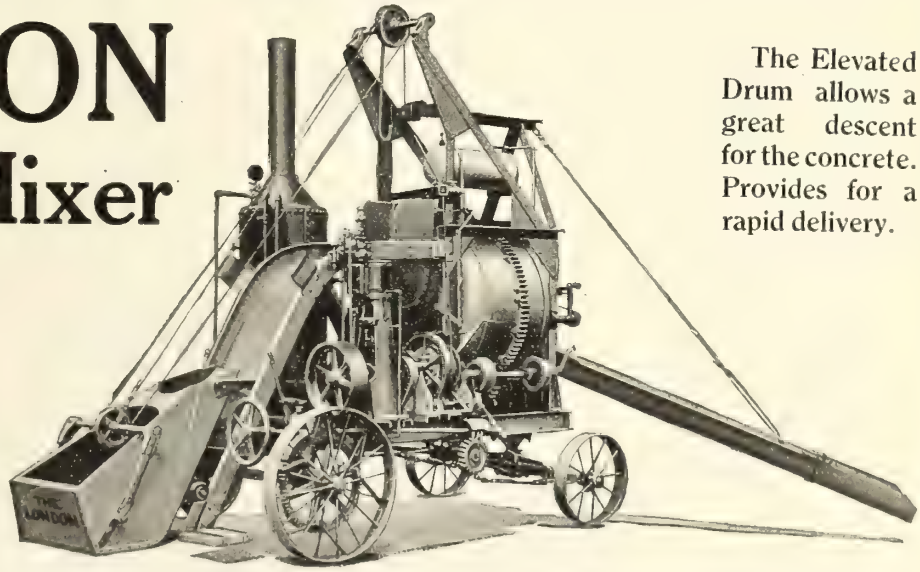
Dartnell, Limited, Montreal
Western Paint Company, Winnipeg
Canadian Equipment & Supply Company, Limited, Calgary and Edmonton

LONDON
Paving Mixer



The Elevated Drum allows a great descent for the concrete. Provides for a rapid delivery.

Forward Loader and Rear Discharge **take up little room on the roadway.**

Traction Drive. Moves anywhere with its own power.

The Rotary Delivery Chute turns in a complete half circle, also opens up at different points. The concrete is distributed to any part of the road **No wheeling. No shovelling of concrete.**

ONE-THIRD LESS MEN REQUIRED. A BETTER JOB. We guarantee that this Machine will deliver Concrete on a roadway at a saving of 10 per cent over any other type of Machine. Full particulars on request. Send for Catalogue No. 1A.

We have twenty-three different sizes and styles of Mixers.
Also a full line of Concrete Machinery and Cement Working Tools.

THE LONDON CONCRETE MACHINERY CO., LTD.
LONDON, ONTARIO
Branches and Agencies in every large City in Canada
World's Largest Manufacturers of Concrete Machinery and Cement Working Tools

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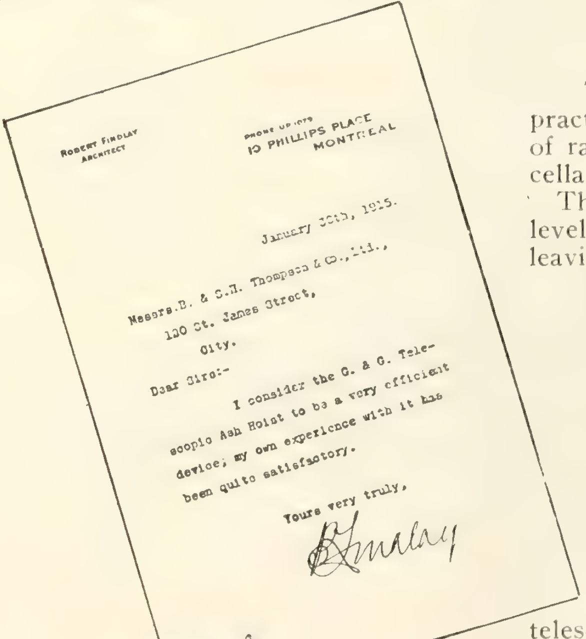
(Continued on Page 14)

A "One-Man" Ash Hoist

The G & G Telescopic Hoist is so designed that it is practical for one man unaided to perform the entire operation of raising ash cans to sidewalk and lowering empty cans to cellar.

The operator standing at sidewalk level can raise 4 or 5 cans without leaving the sidewalk.



ROBERT FINDLAY
ARCHITECT

PHONE UP 1079
10 PHILLIPS PLACE
MONTREAL

January 30th, 1915.

Messrs.B. & S.H. Thompson & Co., Ltd.,
120 St. James Street,
City.

Dear Sirs:-

I consider the G. & G. Telescopic Ash Hoist to be a very efficient device; my own experience with it has been quite satisfactory.

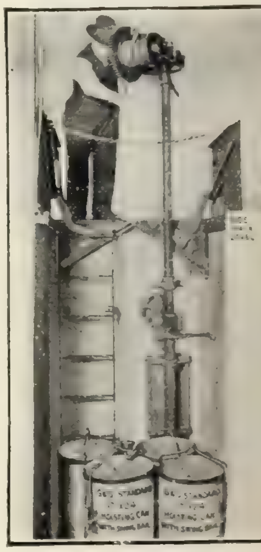
Yours very truly,
R Findlay

Robert Findlay, Arch.

The G&G
PATENTED
Telescopic Hoist
with compound gear and brake attachment

Raises a maximum load of 500 lbs. at a guaranteed speed of 30 feet per minute.

When not in use, hoist telescopes and no part shows above street level. This hoist is fitted with a patented "silencer," making it absolutely noiseless in operation. It can be installed in any building, old or new.



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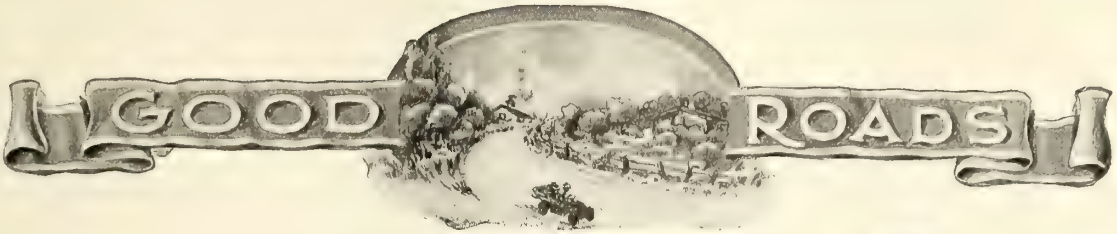

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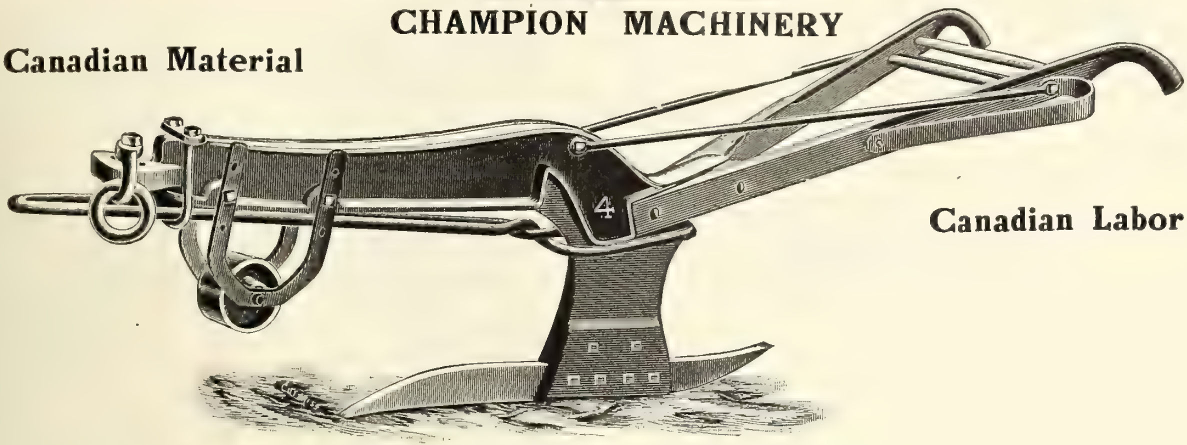
Canadian Material

Canadian Labor



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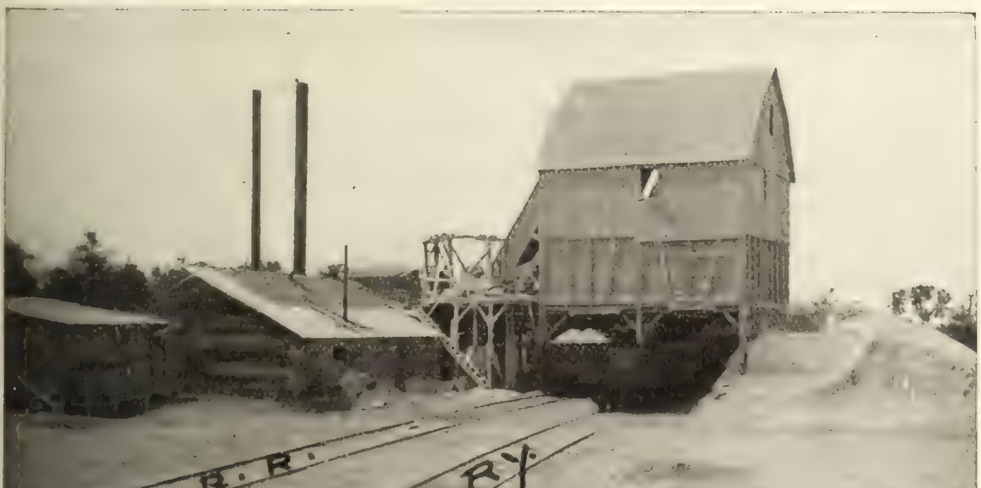
Complete line of Road and Street Machinery, Rock Crushers Stone Elevators and Screening Machinery, Portable Engines and Boilers, Road Graders, Road Plows, Road Drags, Drag and Wheeled Scrapers, Street Cleaners, Sprinklers and Sweepers, Street Cleaners' Hand Carts, etc

THE DOMINION ROAD MACHINERY COMPANY, LIMITED, - Goderich, Ont.

Macadam Roads



must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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ARTIFICIAL MARBLE is polished (not varnished) in the same manner and with the same material as natural marble.

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We manufacture ARTIFICIAL MARBLE in all the beautiful colorings of the Italian, Greek, French and Belgian marbles, and the well known Canadian and American marbles, and our facilities are adequate to turn out the largest contracts.

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CRUSHED STONE

Good Roads Making Good
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Dundas Stone

Best by Test

Canada Crushed Stone Corporation, Limited
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"Superior Graphite Paint"
For the Protection of Steel

Is used so largely because it has behind it a successful reputation of 25 years. Its use insures either exposed or enclosed surfaces, against rust.

Leading ENGINEERS and ARCHITECTS specify "Superior Graphite Paint" for all metal work because for similar work it has shown ACTUAL PROVEN MERIT.

Write for new booklet on PROTECTING STEEL STRUCTURES, and for full information to

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Made in U.S.A. by Detroit Graphite Co., Detroit, Mich.

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The Premier Road Dressing and Binder

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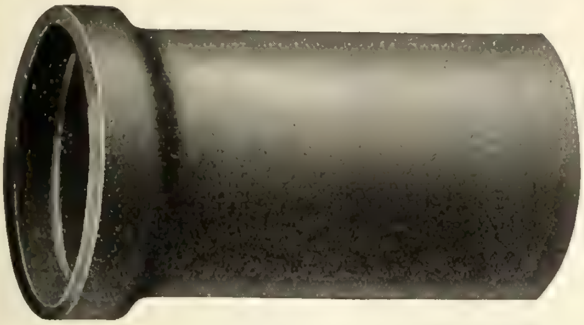
This asphalt macadam binder which we are introducing into Canada has stood the test of time and is offered to the municipalities of the Dominion with the highest recommendations of critical road engineers in Great Britain.

Today the heavy traffic on roads has found the old water-bound macadam unsuitable, and in order to provide a binder and dust-layer which will stand up under these new conditions, "FLUXPHALTE" has been placed on the Canadian market

"FLUXPHALTE" is as easily applied as any binder and gives far better results

Write for copy of our New Booklet.

The Asphalt and Supply Company, Limited
103-107 Board of Trade Bldg. - - MONTREAL



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High Grade Salt Glazed Vitrified Sewer Pipes and connections are a specialty with us. We also manufacture culvert pipes, inverts, flue linings, stove linings, fire bricks, locomotive blocks, gulley traps, range bricks, cupola linings, wall coping and all kinds of vitrified and fire clay goods. Prompt shipments on all goods.

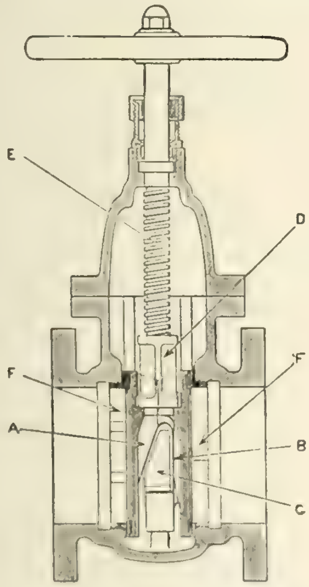
Vitrified Hollow Building Blocks

Made in Canada with Canadian Clay, Canadian Coal, and by Canadian Workmen.

Standard Clay Products Limited

THREE SEWER PIPE FACTORIES : **St. Johns, P. Q., and New Glasgow, N. S.**
ALSO FIRE CLAY FACTORY AT ST. JOHNS, P. Q.

Fairbanks Water Works Valves

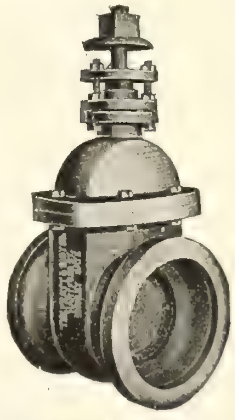


Fairbanks Double Disc Iron Body Gate Valves are particularly adapted to water works installations.

The mechanism permits valves of very staunch and compact design without a clumsy appearance, and offers unique advantages for the renewal of parts with minimum trouble and expense. Ease of operation and absolute freedom from danger of the wedge becoming stuck are valuable features, and the elimination of friction between the bearing surfaces of the wedge faces and seat rings materially increases the durability of these Valves.

The Valve mechanism is a double Gate, simple in construction, and all wearing parts are fully brass mounted.

We are prepared to quote on valves, pipe and fittings for your complete installation and will gladly do so on receipt of blue prints and specifications.



Secure our quotations on Hub End Gate Valves, Hydrants. Valve Boxes, Indicator Posts. Fittings, Pipe, Check Valves.

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Ft. Wililem

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Canada's Departmental House for Mechanical Goods

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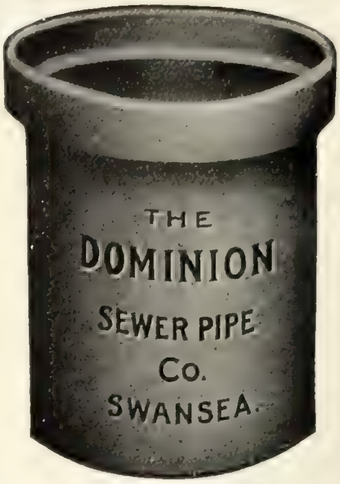

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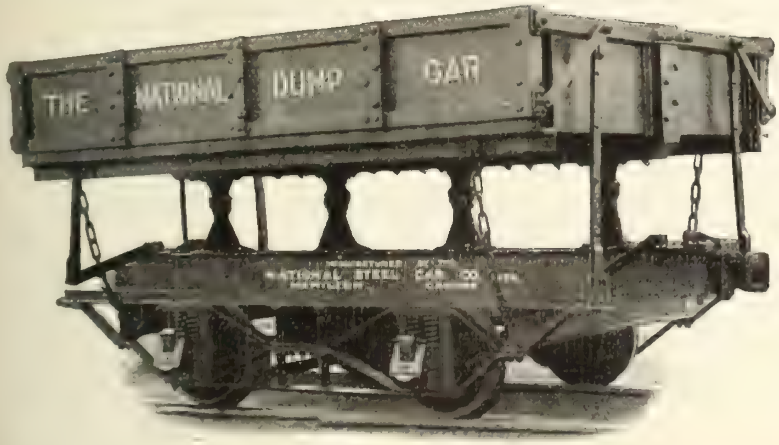

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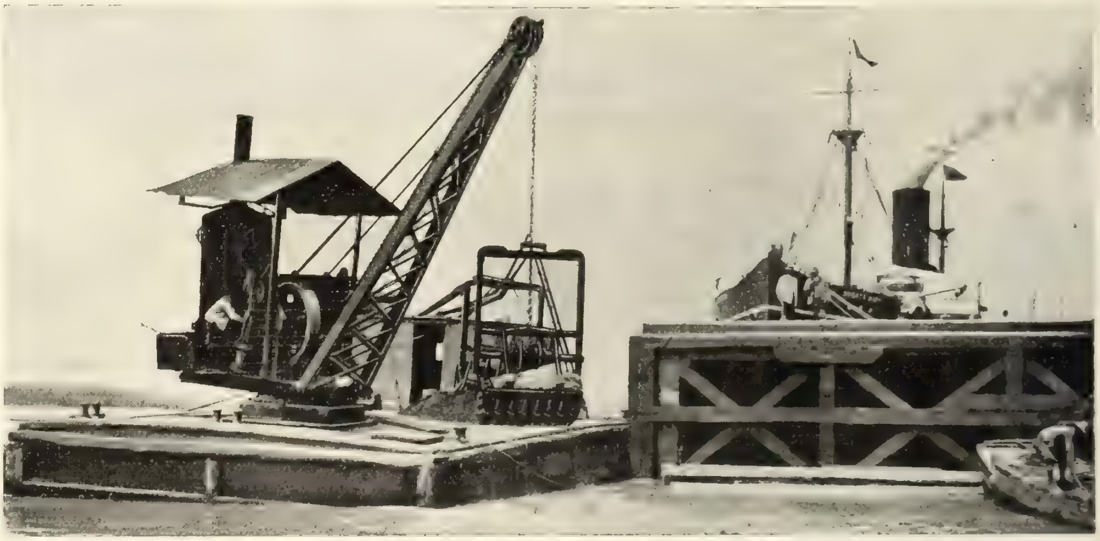

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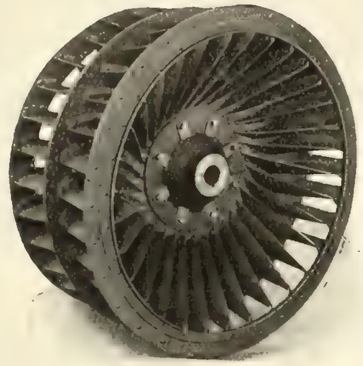

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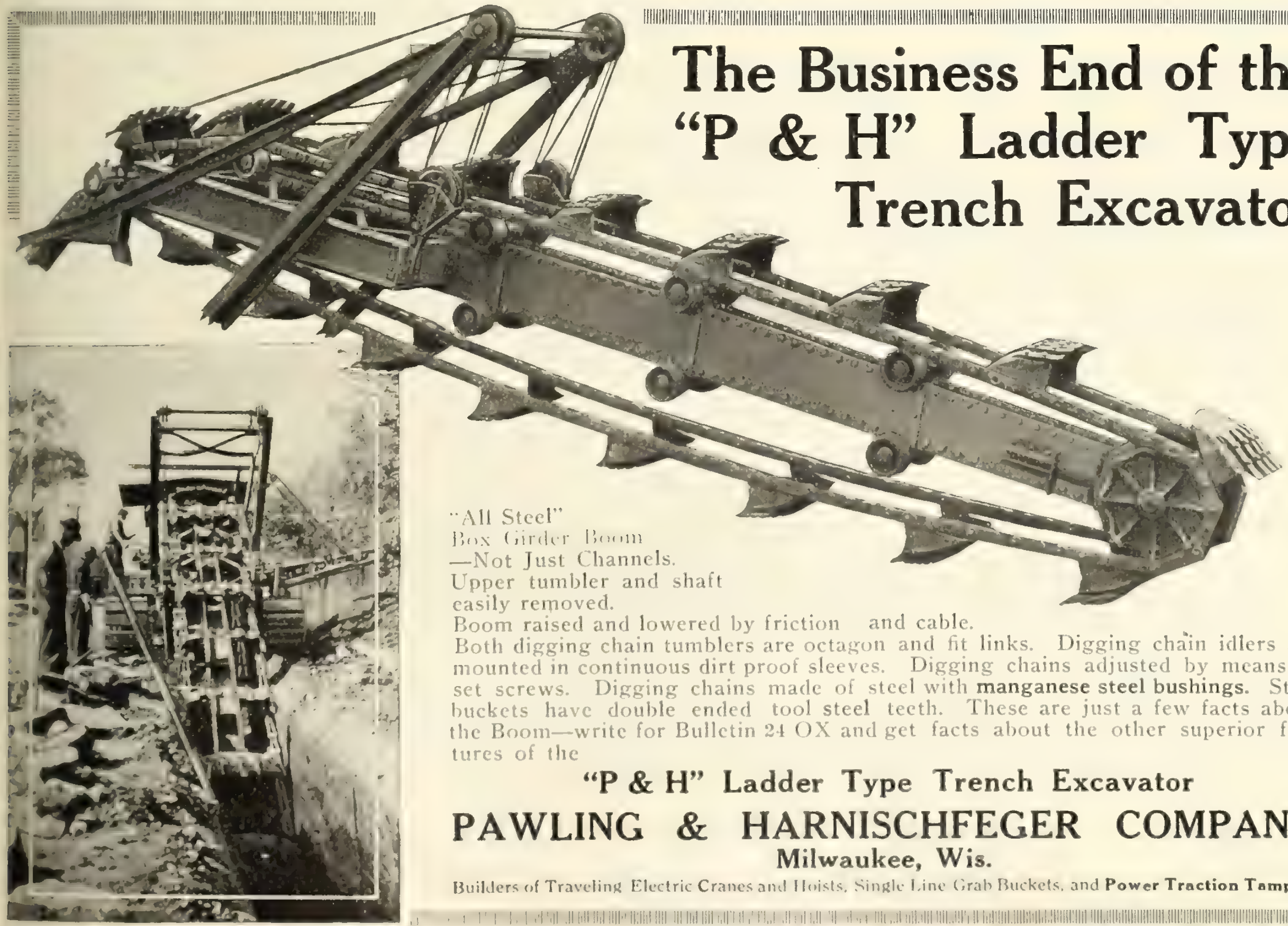

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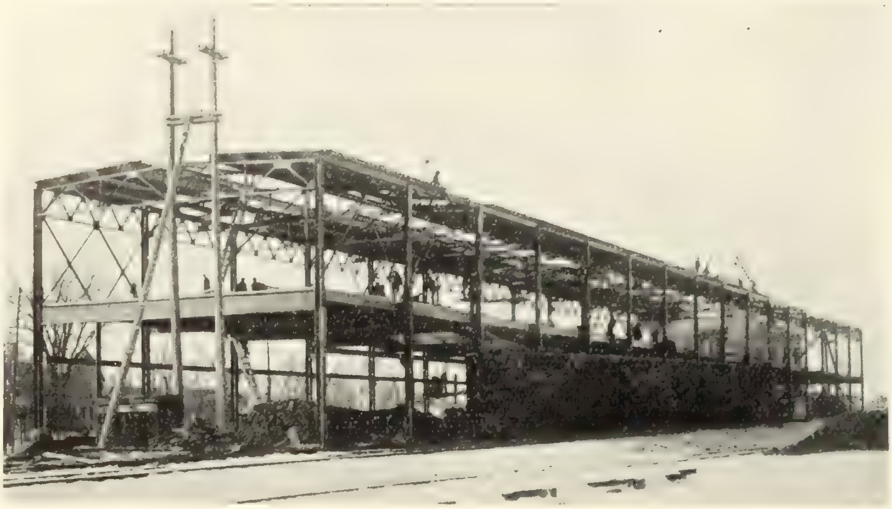

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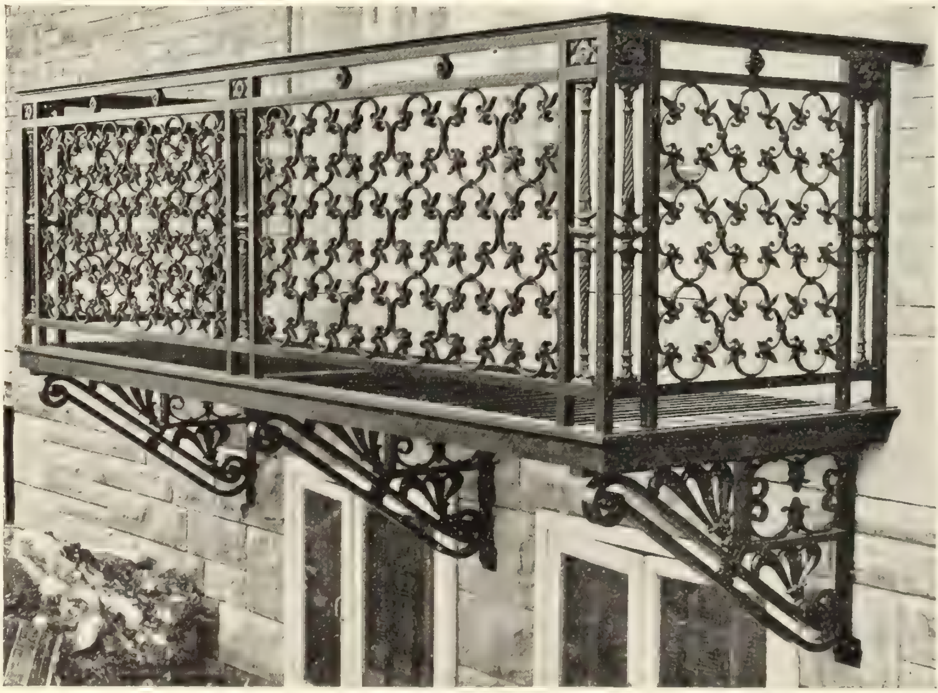

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Public Appreciation of the Engineer in Relation to His Work

A SUBJECT which has caused a great deal of discussion amongst engineers during recent years is the lack of appreciation on the part of the general public of the importance of the work being done by the profession. One would gather from the numerous articles and editorials which have appeared in the technical press that the belief was almost universal amongst engineers that the work of the profession was much underrated. It is very doubtful if they are correct in this view. There is no question but that the larger and more important engineering works appeal very strongly to the general public and excite a great deal of interest. Such undertakings, especially during construction, while it is possible to see the operations being carried out, always call forth expressions of admiration and approval from onlookers. Who has not heard from people standing near, watching the progress of the work, expressions of approval that are most enthusiastic? And the relation of the engineer to such work is always recognized. It is true that after the work has been completed it may appeal to the public as being a great piece of construction, but that the engineer behind it is not so likely to be thought of, any more than is the artist who has painted a great picture. It is also true that there is a large amount of work being done under the direction of engineers which has become so much a part of our everyday life that it is accepted as a matter of course. The engineering behind the work is almost lost sight of by the public, but the recognition of its value is there, although it may be almost subconscious. The recognition it receives is probably just as great as it is in the case of the ordinary everyday work of any of the other professions.

Is not the whole question one of the engineer's being subject to the universal human trait, characteristic of each individual, from the office boy to the general manager, of thinking that his work is not appreciated at its true value? Perhaps it is not, but, if not, then neither is that of any one else. A few moments' reflection must lead any engineer to the conclusion that the work of his profession is at least as indispensible from the standpoint of social economy as that of any of the other professions, and on inquiry he would probably find that it is so regarded by all who are in a position to judge of the relative importance of the professions in our modern social life.

While there is no doubt that the work of the profession and its value in the development of the country are highly appreciated, what about the man who does the work—the individual member of the profession? How does he stand in the estimation of the public? It is no doubt true that engineers, as individuals, are not so well known to the general public as are members of the other professions. This is largely due to the fact that usually their work does not bring the man himself directly in contact with any large number of people. Almost every one, at some time or other, has occasion to requisition the services of some member of one of the other professions. He comes in almost daily contact with other professional men, while the probabilities are that he has never met an engineer. The engineer is employed by a company, a corporation, or a municipality, and comes in contact in regard to his work only with the representative of those for whom he is working. There is no doubt, however, that if he is a man of ability and a competent engineer he will be held in as high esteem by those with whom he has direct relations as will any member of any other profession of corresponding standing.

That the engineer does not occupy a larger place in the public life of the community is not to be wondered at, but the fact that he does not do so is not necessarily an indication of any lack of appreciation of his work or of him as an individual on the part of the public. The very nature of a lawyer's work leads him more or less towards a public life; he is personally before the public in a great many of his activities. A doctor's work has not the same tendency, but the practice of his profession gives him a very wide circle of acquaintances. With an engineer who is following the practice of his profession closely the tendency is altogether the other way. Except in the case of those of the profession who follow a consulting practice, his work is likely to confine him to one locality and one piece of work for a period ranging from a few weeks to a few years, while his next piece of work may take him to an entirely different place. A man with a consulting practice has more opportunity to take an active part in the public life of a community, if his inclinations lead him to do so, but he cannot take such part except at a great deal of inconvenience to himself and his work. If a lawyer has any liking for public life he is very likely to drift into it. If an engineer happens to have a similar liking he has to force his way into it against many opposing influences.

One unfortunate circumstance that militates against the standing of the profession is the fact that any person who is capable of measuring a hundred feet with a linen tape may call himself an engineer. Were similar conditions to prevail in the other professions it would most undoubtedly be found that they would be held in very much lower esteem than they are at present. While this may lower the profession in the estimation of the public, it does not alter the fact that the capable engineer will hold in the estimation of the men with whom and for whom he is working the position to which he is entitled.

If the remuneration received by engineers for their services is to be accepted as a criterion of their importance in the community, there may be good reason for their pessimism. However, it is not on account of any misconception of the importance of engineering as a profession, nor is it on account of a low estimate of the ability of engineers as a class, that the financial rewards of the profession are not greater. One of the chief reasons is the competition of men who, without any training or education, attempt to do engineering work. While such men seldom or never find employment on work of importance, their existence tends to lower the remuneration from the bottom to the top of the scale. Another very important reason is the free engineering services given by large mercantile firms. These firms employ engineers at moderate salaries to prepare designs of structures for their customers, and the firm collects what would be a reasonable fee for any engineer from their customer in the shape of profits on the goods sold. And perhaps one other reason is that the engineer is too busy doing his work to spend much time or thought on the acquisition of wealth. The engineering of their way to large fortunes constitutes the life work of many of our wealthy men. That is what they strive to accomplish. The engineer is engaged in building larger, better, and more lasting structures than "fortunes."

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Good Roads in Quebec

THE Quebec Provincial Government have claimed, and have been given, a great deal of credit for their good roads policy. They have been strenuous supporters of the Good Roads movement, and were represented at the conventions held in Montreal and Toronto. The Acts passed by the Legislature are no doubt calculated to improve enormously both the main and local highways by giving easy terms to municipalities and by encouraging the construction of roads which will prove beneficial to the farmers as well as to urban residents. There is, we are informed, another side to the story which is proving very detrimental to many contractors. Last year, at the invitation of the Government, municipalities applied for loans, and, on the specifications being passed, let numerous contracts. As the work was commenced in the fall, these contracts were only partially completed. The contractors all over the province had invested hundreds of thousands of dollars in equipment, and naturally believed they would be allowed to resume the work at the beginning of the season, and would also be able to secure additional contracts. In this they have been disappointed. They relied on the Government's promise to finance such projects, and on the fact that at the last session a further Bill was passed for raising another $5,000,000. At the beginning of this season many contractors organized their staff and made other preparations to continue the work left over from last year, but no word of authorization came from Quebec, and the contractors found themselves in a quandary. Their expenses were still going on, their machinery was idle, and they were not earning a cent of revenue.

Visits were made to Quebec in order to learn the reason for this stoppage of work, but practically no satisfactory answers could be obtained. The contractors were told that, although the Government had ample funds, it had been decided that each municipality should not construct more than two miles of road under the old contracts, and that no new work would be allowed. The decision was based on the European situation, it being held, apparently, that this is not a time for road work to go ahead, even though contracts had been partially completed. The injustice of the decision (state the contractors) will be seen when it is stated that in some instances this two miles of work had to be divided among several firms. While the Government were making up their minds as to their policy many contractors were doing their best to hold their men together, involving a large expenditure for which they will not be able to get any return. Many, too, during the winter had hauled the stone they expected to use during the present season, which meant the investment of very considerable capital, now lying idle. Such is the present position, and unless the Government reverse their policy many contractors will not turn a wheel, and will be substantial losers.

As previously stated, the Government intimated that no fresh contracts would be sanctioned. The contractors claim that, notwithstanding, new work has been given out—some in districts where only a portion of the old contracts—the two miles for each municipality—has been authorized. The work on these two-mile stretches, much of which has been completed, will not go far to give the good roads promised and badly needed. Moreover, while there is no money for roads built under contracts let by municipalities, the Government have found funds sufficient to carry out improvements on the main highways.

The Designing of Details

ENGINEERS, as well as other men, are inclined to judge of the importance of their work by the rate of pay which it commands. As the engineer becomes older and more experienced he realizes that certain kinds of work possess advantages which cannot be measured in dollars and cents. The young engineer, however, is naturally attracted to those lines of work which seem to ensure large returns most quickly. It is to be regretted that "detailing" does not at present seem to offer a career to capable young engineers. Unfortunately it is considered merely as a stepping stone to another position, with the result that capable young men are avoiding this kind of work or are remaining in it as short a time as possible. We are just beginning to appreciate the fact that poor details are largely responsible for many failures, and also for many unsatisfactory structures, which, even though they have not failed, cannot be relied upon to carry any considerable overload. Engineers themselves are largely responsible for this condition, because many of them have considered detailing, not as designing, but as mechanical, trade-school work. The designing of details is an important kind of engineering work, and its problems are often sufficiently difficult to command the highest engineering skill.

We believe it is time for engineers to recognize the importance of detail designing, and to adopt measures which will justify engineers of ability in remaining in this kind of work. Efficient detailing requires a thorough knowledge of the strength of materials, of stresses, and of erection procedure, and the old idea that almost any man who possessed a structural handbook and a set of drafting instruments could soon qualify as a detailer was an erroneous one. Adequate pay and a proper appreciation of the importance of the work will do much toward attracting and retaining capable detailers.

Generally, the importance of the structural designer's work has been over-rated, as compared with that of the detailer. For structures of medium size it does not take the highest type of engineering ability to compute the stresses and, with the aid of a handbook, to select the size of the main sections. In bridge work, for example, to obtain the information ordinarily placed on the stress sheet does not often require exceptional ability—in fact, the man just out of college may be much more efficient in computing stresses than the experienced engineer. The prevailing notion that the well-paid engineer's work is completed when he finishes the stress sheet is wrong—it is too much to expect that the poorly-paid detailer can complete the design, as the latter is usually a man with little engineering experience.

If our structures are to be equally strong in all their parts and capable of being erected economically there should be little distinction in salary or in technical ability demanded between the designer and the detailer—in fact, one high-grade man might well do the work now done by both. The extra cost for efficient work under such a system probably would not be greater than that under the system now in use in our large offices if the cost of the "checker" is taken into consideration. The results of tests of full-size members have shown that the actual strength of a built-up member often is only a small percentage of its computed strength, due mainly to weak and faulty details. Engineers are just beginning to realize that they have little definite information on this important subject. It is hoped that the growing realization of this lack of knowledge will act as an incentive to them to make the designing of details a branch of structural engineering work worthy of the attention of capable and experienced engineers.—Engineering and Contracting.

The Mitigation of Electrolysis

By E. B. Rosa[*]

THIS paper summarizes the work which the U. S. Bureau of Standards has done during the last four years in studying the destructive effects of electric current on sub-surface structures and prescribing remedies for the trouble. From the results of its investigations the Bureau concludes that the proposal to fix by State law a general requirement as to voltage drop or current density in the rails is not logical, in view of the great variations in the damage which can result under different conditions with the same voltage drops.

One of the first methods resorted to as a means of preventing damage to buried gas and water pipes by electrolysis and soil corrosion consists in covering the surface of the pipes with a coating intended to insulate them from the surrounding earth. In many cases pipes have been so protected from soil corrosion but it is doubtful whether there is any instance on record where damage by electrolysis has been effectually prevented in this way if the voltage conditions were at all severe. On the contrary, there have been cases where such coatings have done actual harm, as they tend to fail in spots, and so permit the current to escape from the pipes at such places with a greater current density than would be the case otherwise, and so aggravate the local damage.

The paints, dips, and wrappings tested by the Bureau of Standards were found to be of little or no value in protecting pipes from electrolysis when applied to the positive areas near power stations where the current is tending to leave the pipes. The Bureau has come to the conclusion that money can be expended more profitably in other directions than in an attempt to insulate gas and water pipes from the earth.

Insulating Joints

The Bureau has found insulating joints of great value in reducing the current in pipe lines, and so reducing the corrosion caused by such current. Where the potential gradients are high the joints must of course not be placed too far apart, as in that case the potential difference at each joint would be sufficient to cause considerable joint electrolysis. Insulating joints should not be depended upon as the sole means of protection to pipes, but they are economically and mechanically practicable, and are a very important auxiliary means of protection, particularly in the case of gas pipes. They are used less often in water pipe lines.

Track and Pipe Drainage

Alternative methods of electrolysis mitigation are by the track drainage system and the pipe drainage system. The first of these methods is to be preferred if it can be carried out economically. It has, however, been thought by many to be prohibitive in cost, and has been very little used in American cities. The pipe drainage system, on the contrary, has been strongly advocated and in one form or another much used. The investigations of the Bureau of Standards, which have been extended over several years, have convinced its members that the pipe drainage system as a principal method of protection is not only complicated and expensive to install and maintain, but is in the long run not an adequate remedy for electrolysis troubles. On the other hand, the track drainage system when properly designed and installed is simpler, more effective, and far less expensive than has been supposed.

---

[*] Chief Physicist, U. S. Bureau of Standards, in Engineering Record.

Owners and managers of water-works should co-operate with the gas and telephone companies and railways in studying the problem of electrolysis mitigation in an open-minded and progressive manner. The taking of the matter into the courts is to be deplored. It is better to employ engineers to work together to solve the problem in a thorough and efficient manner than to employ experts to testify in court as to who is responsible or what are the damages. As the damage is cumulative from year to year and the rate increases as the traffic increases, there will be no better time than the present to take up the matter.

Considerations Affecting the Design of Highway Bridges

By Willis Whited[*]

THE engineer designing bridges for public use is always more or less at a loss to know what loading to assume for bridge floors. Curbs and railings offer further doubts. A few of the difficulties are outlined in the following article, with suggestions embodying the writer's opinion.

Roadway Loading

Unusual loads.—Should he assume the heaviest known loads and design with the ordinary unit-stresses? In large cities this is good practice, but even there the engineer is hardly justified in designing all the bridges in the city, large and small, to carry the heaviest monuments, castings, steel beams, building members, or stone columns that can be brought into the city. A limit must be fixed somewhere, beyond which the owner of the load is obliged to provide for its transportation by strengthening bridges, adopting different lines of travel, dividing up the load, using special trucks, or otherwise. It seems extravagant to add a large percentage to the cost of a bridge in order that it may carry a load heavier than is likely to be brought to it once in five years, especially as the necessity of carrying such loads is rarely absolute.

Street cars.—It would seem that all bridges except on boulevards and in parks should be designed to carry street cars, whether they are actually used on that street or not. It is impossible to accurately forecast the growth of a city or to know what traffic is to come on a given street in twenty-five years. Street cars are with us, and must be provided for, and we can only guess as to the weight they are likely to attain.

It would probably be desirable to build bridges in parks and boulevards no heavier than is necessary to carry the heavy class of automobiles and the road rollers used for paving such roads, thus placing an obstacle in the way of the street railway corporation's grabbing such roads by hook or by crook to the detriment of the traffic they were intended to carry. The same may be said of inter-city highways which are only wide enough to carry two lines of traffic.

Bridges in public streets should be built to carry inter-urban cars weighing 50 tons each. While this is much heavier than ordinary cars, it must be borne in mind that suburban cars are destined to a wide extension, and almost any street in a city is liable at some future time to be called upon to carry them.

Motor trucks.—Roads between large towns are, it seems to the writer, destined eventually to be subjected to the traffic of heavy motor trucks which will carry miscellaneous freight from store, factory and warehouse to residence, or from the small town or the country to the warehouse in the city.

So long as rubber is used for tyres, and the present materials for paving, it is hardly to be feared that the gross weight of the truck will greatly exceed 20 tons, with about two-thirds of the weight on the rear axle. In the opinion of the writer, all bridges on important thoroughfares should be designed to carry the load, which will safely cover traction-engine loading.

There are bridges in remote districts which could not without extravagance be built to carry 20-ton trucks; but the road roller and traction engine are a permanent institution. I would recommend for such bridges a 12-ton roller as the lightest design load for any bridge on a public road. Sometimes there is difficulty in deciding whether a given district will remain remote. I would recommend resolving all cases of doubt in favor of the heavier loads.

Cases often arise in which designing a very large bridge for the heaviest loading would add so much to the cost as to be an unreasonable burden on the taxpayers, while there is another route not requiring such an expensive bridge which would carry exceptionally heavy loads without undue inconvenience to the public. In such cases notices should be placed warning vehicles carrying loads exceeding a certain amount to take some other route. The driver of a heavy load may feel like taking a chance; nevertheless, there is plenty of law holding him responsible for the resulting accident.

Sidewalk Loading

While roadway loadings are subject to change as above noted, sidewalk loadings cannot change as the years pass, either in character or amount.

Crowds.—The weight of a dense crowd of people has in some cases by special exertion been brought as high as 150 lbs. to a sq. ft. of floor, but such loadings are so rare that it seems to the writer not unreasonable to allow stresses under this intensity of loadings to approach the elastic limit. An ordinary standing crowd will rarely weigh more than 80 lbs. to the sq. ft., and the only occasion on which crowds even of that density will be gathered will be in cases of some local excitement, such as accidents or similar occurrences in the water or the roadways. In such cases the densest part of a standing crowd can hardly be more than four deep; those in the rear will keep moving, and a crowd with freedom enough to move at all will rarely exceed 40 lbs. to the sq. ft. An assumed sidewalk load of 100 lbs. to the sq. ft. on a 4-ft. width, with 50 lbs. to the sq. ft. on the rest of the sidewalk, is ample for any kind of a bridge, but should be provided for in all bridges, whether urban or not, because any district sufficiently populous to require sidewalks at all on the bridge will occasionally produce crowds of considerable density.

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[*] Bridge Engineer, State Highway Department of Pennsylvania, Harrisburg, Penn.

Dense crowds of much greater depth occasionally collect to listen to musicians or street speakers, but such gatherings are never allowed on bridges.

Snow.—It is hardly possible for crowds to become so dense in cold weather. Since the weight of ice or snow seldom exceeds 13 lbs. to the sq. ft., it is not necessary to add anything for its weight.

Runaway vehicles.—If the bridge is at the foot of a steep grade it may happen that street cars, escaping from the control of the motorman, will leave the rails and go over on the sidewalk. It may be worth while to allow for such accidents in designing sidewalks, by making the curb high and strong enough to prevent vehicles getting on the sidewalks, i.e., never less than 6 ins. high, and often more.

In providing for the case of a car actually mounting the curb and running on the sidewalk three times the normal stress could be allowed; this might result in badly damaged sidewalks, but would prevent loss of life.

The planks or other details of the sidewalk should be designed to carry not less than 250 lbs. concentration, because people of that weight are not uncommon, and a person in walking always places his whole weight on one foot. Plank walks are rapidly going out of use, but they will be with us for many years to come.

In fixing the thickness of a plank a reasonable allowance must be made for wear and deterioration.

Curb Height

Horse-drawn vehicles.—Even in the case of a runaway the vehicle must follow the horses. Horses, except when under the spell of frenzied fear, will never bolt over a fence, and therefore it would seem that, where there is no sidewalk, a reasonably high fence on a curb of about 6 ins. is all that is required. If there is a sidewalk it is well to make the curb about 16 ins. high, which only the lightest wagons could mount. But the sidewalks should be made sufficiently strong to carry the weight of a horse and a light wagon without greatly exceeding the elastic limit.

Automobiles.—The ordinary touring car is very often driven at a high rate of speed. Occasionally the driver loses his head, or the steering gear gets out of order, in which case the car is liable to mount the sidewalk. The best preventive of this accident, perhaps ould be to make the curb about 16 ins. high and sufficiently substantial to resist the impact of the car.

A 10-in. curb is sufficiently high to take care of most accidents. But where there is a sharp curve on the approach, or where the bridge is very wide, so that an unruly car would be liable to strike very nearly square, the higher curb is imperative.

As to motor trucks, which travel at a much lower rate of speed, the driver will probably become aware of accidents to any part of his machine in time to stop before the truck mounts the curb.

Railings should be made to resist a lateral pressure applied at their tops equal to one-fourth the weight of a row of men leaning against it, or approximately 40 lbs. to a lin. ft. If the railing is not so constructed that it is impossible for men to climb upon it, it should be strong enough to sustain a vertical load of at least 100 lbs. to a lin. ft.

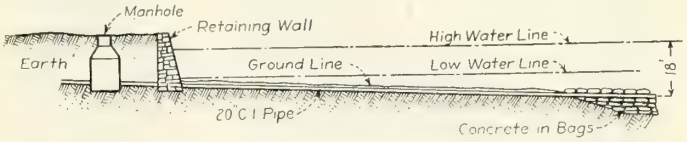
If the railings are on a sidewalk, there should be no opening more than 6 ins. wide, on account of the danger to children, either by walking between the balusters or falling down and rolling underneath.—Engineering News.

Cost of Depositing Concrete in Bags Under Water

By H. R. Ferriss, Victoria, B. C.[*]

A 20-in. cast iron outfall was laid from a point on shore to a distance of 720 ft. out from shore, at which point the end was in 18-ft. depth and a swift off-shore current. The outfall follows a channel between high rock reefs, and the pipe for its entire distance—with the exception of 120 ft. of the outfall end—is laid in a ditch dredged in clean sand. At the outfall end the floor of the sea falls away somewhat faster than the grade of the pipe, and advantage is taken of this to hold the end of the pipe line off the floor of the sea. It was considered advisable by the engineer in charge to rest the pipe on concrete deposited in bags, and the outermost end, owing to the swift current and heavy winter storms, is heavily anchored with concrete in bags.

A 1:3:6 mixture was used. A scow was anchored near the outfall end, and aboard it the concrete was mixed and sacked dry. The sacks of concrete were then lowered in a sling, and placed one at a time, by the diver, who afterwards ripped them open with a knife as placed. The concrete showed no sign of setting up for two days. After the seventh day it was fairly well bonded. It is now, after one year, a fairly good mass of concrete, which shows no damage, either from the swift current or from storms, from whose action, except the fiercest, however, it is probably protected by its depth.



Section showing location of outfall.

It will be noted that the costs of labor only are given, and they depend considerably on locality and weather, which in this instance was exceptionally fine. The costs of materials are easily ascertained for any locality. The costs for the use of scows, engines, etc., will depend entirely on locality and weather conditions. The amount of concrete deposited was 80 cu. yds. and it cost as follows:

Sacking and Mixing Concrete:	Total	Per Cu. Yd.
Foreman, 19 hrs. at 35 cents … …	$ 6.65	$0.082
Labor, 400 hrs. at 30 cents … … …	120.00	1.500
Placing:		
Diver, 120 hrs. at $1.00 … … … …	120.00	1.500
Tender, 120 hrs. at $0.50 … … …	60.00	0.750
Compressor eng., 60 hrs. at $0.40 … …	24.00	0.300
Labor, 250 hrs. at $0.30 … … … … …	75.00	0.938
Total … … … … … … …	$405.65	$5.070

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[*] In Engineering and Contracting.

A Combined Power, Pumping and Filter Plant

Details of Municipal Undertaking at Medicine Hat, Alberta—Boilers Fired with Natural Gas to Provide Steam for Turbo-Generators

By W. S. Lea*

IN 1912 the City of Medicine Hat, Alberta, undertook the installation of a new power, pumping and filter plant. The existing works included a pumping and filter plant on the south bank of the South Saskatchewan River, about one-quarter to one-half mile from the centre of the city, and an electrical power plant, built a short time previously, about two and one-quarter miles further up the river. The equipment in this power plant included two 125-kw. alternators driven by engines operating on natural gas. In the pumping plant both gas and steam engines were in service. The general elevation of the built-up portion of the city is about 90 feet, and the water distribution system was in connection with a 400,000-gallon standpipe with its top at El. 274. It was too low to provide pressure for the higher parts of the city, which were being rapidly developed.

. City Reservoir, Medicine Hat.

Without going into details, the existing works were so inadequate that it was absolutely necessary to install a new pumping and filter plant. As the recently constructed power plant had not been entirely satisfactory, it was also considered advisable to provide for a moderate commercial power load in the new installation. A combined power, pumping and filter plant was therefore decided upon, to be erected on a site on Noble Street adjacent to the existing power plant.

The population of the city was then about 11,000, the commercial power load (electric) about 130 kw., and the average daily per capita water consumption, including a supply for the Canadian Pacific Railway, about 150 gallons. The South Saskatchewan River is the only available source of water supply; this river is not badly polluted, but, like most Western rivers, the turbidity is high during the spring freshets.

Medicine Hat is situated in a splendid agricultural district and a famous natural gas field. An abundant supply of gas for all purposes has been developed in the city, and the Corporation was in a position to furnish gas of a high calorific value for the new plant at a merely nominal rate—approximately one cent for every 1,000 cubic feet. It was offered for industrial use at five cents per 1,000 cubic feet, and large users were permitted to use certain wells on exceptionally favorable terms, practically at cost. This consideration naturally suggested the probability that the bulk of the power required for industrial purposes would be developed from privately-owned gas wells.

At the best, the power proposition was an uncertain one to deal with, as the city was experiencing a development approximating a "boom," and the usually accepted formulas for growth in industries and population might not apply. However, it appeared reasonable to expect that within a few years the water consumption would be doubled and that the average combined pumping and industrial power load would range from 600 kw. to 1,200 kw., about one-half of which would be required by the pumps and auxiliaries in the power station.

The conditions determining the general scheme of improvements were briefly as follows:—

The water supply had to be taken from a river with 30 feet range in level from low water to flood water (El. 65 to El. 96). In the dry weather season the river is so shallow that the intake had to be located at midstream, and this intake and the intake pipe had to be protected, if possible, against damage from ice jams, which are liable to occur with rising water in the spring.

The topography of the site for the plant varies from contour 90 at the river bank to contour 107 at Noble Street, fronting the site.

A water supply for domestic and fire purposes had to be provided, with a distribution system ranging from El. 90 to El. 220 or higher. Wood pipe had been installed in some sections of the lower levels. Speaking generally, the old system had not been designed for the working pressures which would be imposed upon it if in direct connection to the system for the higher levels. Moreover, apart from the heavy fire draught which must be provided for in a city of this size, the so-called domestic consumption varied to an unusual degree, owing to draughts for railway and industrial purposes and the heavy use of water for lawn and street sprinkling, etc.

Fortunately, a site for a service reservoir was available immediately south of the new plant. This site was of sufficient area to accommodate any future extensions which might be required, and, being at El. 370, could provide fairly satisfactory pressures, since the business and manufacturing districts are on the lower levels.

Equipment of Plant

The selection of the type of prime mover to be adopted for the new plant was an important matter. The choice lay between gas fired steam boilers with turbo-generators and gas-engine driven generators. The steam plant was the cheaper one to install, was more flexible, and was considered more reliable and easier to maintain, but was admittedly inferior to the other from the point of view of fuel consumption. An-

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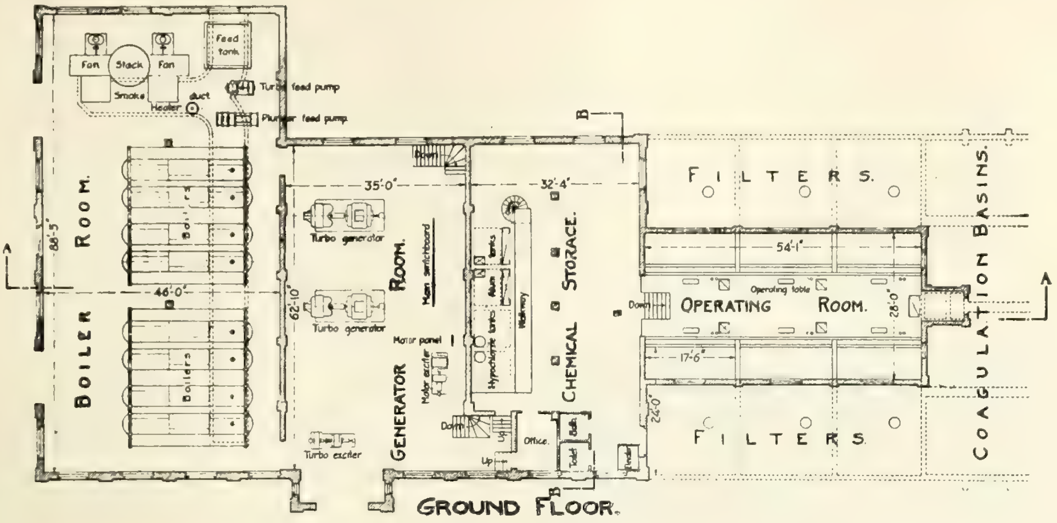
* Of the firm of R. S. & W. S. Lea, consulting engineers, Montreal.



Plan of ground flour.

other factor which had to be considered was the possibility of the city's being obliged to resort to the use of coal fuel. It is considered unlikely that such a contingency will arise, at least during the life of the present plant. Both types of prime mover permit of changing over to the use of coal, but the steam plant is the more convenient and economical in this respect, as no provision in the power station for additional equipment is needed. Hence, having regard to the low cost of fuel, it appeared that the considerations governing the choice of prime mover were, in order of importance:—1st, simplicity and reliability; 2nd, first cost; 3rd, cost of operation, including operators' salaries, cost of renewals, and repairs. Gas fired boilers and turbo-generators were therefore recommended, with all pumps and other secondary equipment motor-driven except the boiler feed pumps and one reserve exciter unit.

The scheme recommended included:—

1. A concrete intake pier with a 30-inch cast iron intake pipe from it to a suction well on the river bank, which was already under construction.

2. A 6,000,000-gallon-a-day mechanical gravity filter plant, with provision for a minimum of three hours' sedimentation and a clear water basin under the filters with a capacity of 125,000 gallons.

3. Three 3,000,000-gallon-a-day low lift pumps for pumping raw water from the suction well to the coagulation basins or to the condensers as hereafter described.

4. Three 3,000,000-gallon-a-day high lift pumps for raising filtered water from the clear water basin to the service reservoir or pumping it into the distribution system.

5. Four 400 h.p. water tube boilers set in two batteries.

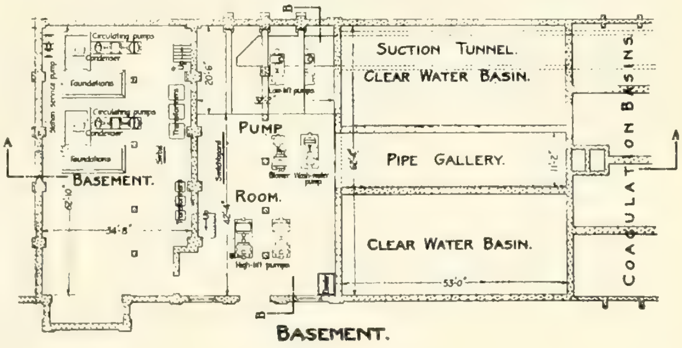
6. Three 750 kv.a. condensing turbo-generators with an overload capacity of 25 per cent. for two hours.

7. A 3,000,000-gallon service reservoir on the site previously referred to.

8. 9,500 feet of 20-inch rising main from the plant to the reservoir, with an 18-inch feeder off the main along Sissons Street for 11,000 feet to connect with the low level system through a pressure regulating valve set to maintain a pressure on this system practically the same as that previously afforded by the old standpipe.

On account of the occasional flooding of the site adjacent to the river during high water and the necessity of placing the low lift pumps in a pit to be within a reasonable suction lift of the river in low water, the general layout of the plant and the relative floor levels are as illustrated.

The coagulation basins are in two units, each with a preliminary and a final basin. The filters are in six units, each of a capacity of 1,000,000 gallons a day, and are 17 ft. 6 ins. by 24 ft. in plan. The clear water basin is beneath the filters, immediately adjacent to the coagulation basins, and with its floor at the same level as theirs. The effective depth of the sedimentation basins is 16 ft. 6 ins., and the effective depth of the clear water basin is reduced by provision for the drop through the filters to about 6 feet.



Plan of basement.

Power Plant

The boiler room and generator room floors are on the same level. The boilers are gas-fired, and induced draught is provided by two steam-driven fans in the smoke duct, discharging immediately above the roof through an 8-foot steel stack. Each boiler has 4,020 sq. ft. of heating surface. There are two feed pumps—a multi-stage turbine pump driven by a steam turbine, usually in service, and a reciprocating pump as a standby. Both feed pumps have suction connections under a moderate head from a concrete feed water tank in the corner of the boiler room, which can be filled off the discharge main or by the service pump drawing from the sedimentation basins. The feed pumps and fan engines exhaust into a Reilly multi-coil vertical heater.

Each turbo-generator unit consists of a Fraser and Chalmers 3,600 r.p.m. steam turbine direct connected to a Siemens 2,200-volt, 3-phase, 60-cycle, 750-kv.a. generator. A Koerting ejector condenser is provided for each unit, and the injection water for the condenser is taken from the discharge header of the low lift pumps through a small centrifugal booster pump to increase the pressure of the discharge of the low lift pumps sufficiently for the condenser supply. The discharge from the condenser enters an open concrete hot well. A common motor drives both the booster pump and a small centrifugal return pump with submerged suction in the hot well which returns any desired proportion of the water from the hot well to the coagulation basins. This is effected by connecting the low lift pump header through a pipe with the discharge of the return pump. After the junction of the return pipes, the water flows through one pipe equipped with a water level controller, to the coagulation basins. Thus there are, so to speak, two circuits for the low lift pump discharge—one through the booster pumps, condensers and return pumps to the common supply main to the basins, and the other direct to this common supply main from the low lift discharge header. By simple hand regulation it is possible to turn any proportion of the low lift pump discharge into the coagulation basins for the domestic supply, or any proportion of it may be used for condensing purposes and afterward returned to the coagulation basins for domestic use, or allowed to waste to the river through an overflow and drain from the hot well. All of the condensing water automatically runs to waste when the filters are shut down.

Gas fired boilers.

There are two exciter sets for the main units—one motor driven, and the other direct connected to a Terry steam turbine.

The main switchboard has eight panels—two for the generator control, one for the exciter control, one for the Tirrel voltage regulator, two for the outgoing lines, one for the high tension current supply to the high lift pump motors, and one for the supply to the transformers, which deliver 220-volt current for the low lift pump motors, wash water and circulating pumps, blower, exciter, lighting, etc.

The condensers, circulating pumps, air duct to turbines, service pump and transformers are located in the basement under the generator room.

The pump room floor is on two levels. On the higher level, which is at the same elevation as the generator basement floor and the floor of the filter pipe gallery, are the high life pumps, the wash water pump and the blower for the filters, and the switchboard controlling these units. The low lift pumps are on the lower floor, or in the pump pit, with shafts about 17 feet above low water. These pumps have independent 16-inch cast iron flanged suctions, laid in a concrete tunnel passing under the west coagulation basin to the suction well. These suctions are provided with foot valves, and the pumps are also equipped with ejectors for priming. The high lift pumps are two-stage Drysdale turbine pumps, direct connected to 325 h.p. Siemens induction motors, taking current at 2,200 volts.

Filters and Intake

The coagulant storage and chemical mixing and dosing equipment is immediately over the pump room, and is connected with the generator room. There is a one-ton hydraulic elevator to this floor, and a ten-ton travelling crane in the generator room.

The building is of reinforced concrete with brick and tile curtain walls and a flat concrete roof covered with Johns-Manville asbestos roofing. The roof of the filter plant is slated.

As originally designed, the plant is capable of handling easily from 5,000,000 to 6,000,000 gallons of water a day and generating 1,200 kw. of electrical energy for pumping and commercial purposes, with one boiler, one turbo-generator, one high lift pump and one low lift pump in reserve. It is true that this leaves no filter reserve, but as a matter of fact the months of maximum water consumption in Medicine Hat are not the months of maximum turbidity, and, allowing for washing, the effective capacity of a filter tank is about 97 per cent. of its nominal capacity. If one filter tank were out of commission, 5,000,000 gallons of water a day could be easily handled at the least. In cold weather, one low lift pump can supply enough cooling water for two turbo-generators, but in the summer two low lift pumps are required for this service if it is

Turbo-generators and switchboard.

desired to limit the temperature of the water entering the coagulation basins to about 80 deg. F.

Condensing turbo-generators were adopted because, apart from being more efficient, this feature resulted indirectly in a lower first cost for the whole plant on account of the smaller boiler capacity required, thus showing a saving in the cost of buildings as well as in the cost of boilers. Impulse turbines and ejector condensers were adopted on account of their simplicity and reliability.

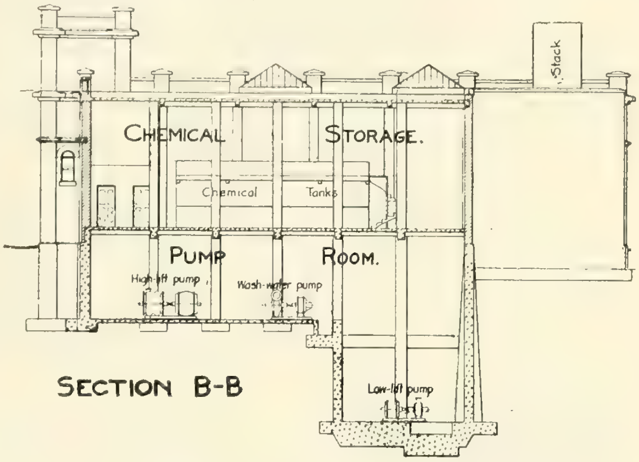
The plant is so designed that it may be extended westward by additions similar to the original installation.

On account of the ice jams and low water in certain seasons, the intake pipe had to be laid in a trench in the river bottom and the intake pier had to be designed either massive enough to withstand any ice shove or low enough to escape the worst effects of one. It is doubtful if the integrity of the pier could be guaranteed by any design at a reasonable cost, and it was decided to adopt a low concrete structure with a gently sloping upstream face, carried below the river bed. The inlet to the pier is through a removable iron screen set in the outer face parallel to the direction of the current. This inlet is in the deepest part of the river, and its sill is above the river bottom. The 30-inch cast iron intake pipe enters the pier below the river bed and is carried in a trench to the suction well. There is a circular emergency opening countersunk into the top of the pier and covered with a very coarse grid, over which is placed an iron cover with a fixed vertical ring handle for easy removal. Provision is also made for blowing off this cover by the back pressure from the street mains, which are connected to the intake pipe, should it become impossible to remove it in any other way. The emergency inlet is for use only if the regular inlet become choked with debris, frazil, etc.

The suction well is provided with a concrete roof with cast iron covers for the manhole and gate rod openings, as well as an opening for the removal of the screens. The low lift pump suctions are protected by fine copper screens, in duplicate, which may be operated and inspected from a floor at their tops.

Distribution Main

A 20-inch discharge main, 9,500 feet long, runs from the station to the new 3,000,000-gallon reservoir. About 3,700 feet from the plant the 18-inch main along Sissons Street is taken off, as previously mentioned. Mannesmann lap welded steel pipe was used for all the pipe work. All the joints, except for the first 125 feet from the station, were of the bell and spigot type and leaded. Immediately adjacent to the plant flanged pipe was used. A Simplex Venturi meter is installed in this section, with indicating and recording apparatus in the generator room. In this room there is also a device which records the water level in the reservoir at any time, with high and low water alarm. In connection with the Venturi charts, the records from these gauges provide a means for not only determining the total draught, but also the draught throughout the day and its variation. The high and low water alarm can also be connected with the City Hall.

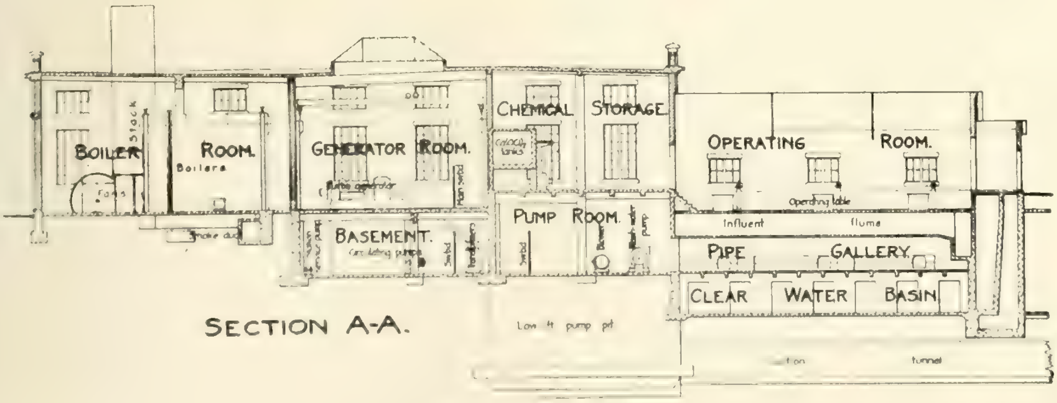


Section through plant, showing pump room and chemical storage.

Constructional Details

The contract for the first construction in connection with this project was let in September, 1912, and the plant was in service about a year later, though scarcely completed. Fyshe, Martin & Company, of Calgary, were the contractors for the power plant, suction wells, intake, etc., and jointly with the New York Continental Jewell Filtration Company, of New York, were contractors for the filters, which were installed and equipped after the filter company's designs. Fraser and Chalmers, of Montreal, supplied the main units, piping and auxiliaries and the high lift pumps. Babcock and Wilcox furnished the boilers, the Green Fuel Economizer Company the fans, and the Gwynne Gas Burner Company the gas burners.

The reservoir was built by Hotson, Leader and



Longitudinal section of plant.

Goode, of Medicine Hat, and the sub-station by Sackrider and Turner, of Medicine Hat.

The construction work of the new plant was carried on continuously during the winter, and in spite of this handicap was very well executed.

By taking the feeder for the city off the rising main at Sissons Street the head on the constant speed turbine pumps is not expected to vary greatly with increased friction in the pipes after they have been some years in service, because, with the same number of units in service, the friction head will probably increase with time from the pumping station to Sissons Street, but, as the draught from the city should be greater with a larger population, the flow from Sissons Street to the reservoir will be less, which will tend to lower the friction head in this section.

Storage Reservoir

The reservoir is a rectangular covered reinforced concrete structure, 96 ft. by 208 ft. by 21 ft. 2 ins. High water is at El. 380.67. One side wall has been designed to be self-supporting with the earth backing removed, so that it may serve as a dividing wall when the reservoir is extended. Keyways and exposed steel reinforcement are left at the ends for tieing in the extension.

The reservoir is provided with the usual piping to ensure circulation and permit of its being washed out. An overflow is provided also. The necessary gates and connections are located in a concrete gate house with a brick superstructure, which is carried beyond the corner of the completed reservoir to serve precisely similar functions for the next extension.

Operating floor of filter room.

The reservoir, like the coagulation basins, has a beam and slab roof and buttressed walls, reinforced horizontally. The design of the walls, slabs and buttresses was based on the assumption that the earth would exert a pressure equivalent to that of a fluid weighing 15 lbs. a cubic foot when the reservoir was full and 33 lbs. a cubic foot when the reservoir was empty. The upper 6 or 8 feet of the walls is necessarily heavier than is actually called for on this basis of design, and is stable enough to stand alone, even if the earth backing were removed, or shrunk away from the wall to this depth. One advantage of this type of wall is that the main reinforcement serves as temperature reinforcement as well, and very effectively distributes any vertical cracks.

The leakage test of this basin was considered very satisfactory. The total leakage in 96 hours was only ¾ inch under about 18 feet head—i.e., less than ¼-inch a day. No special waterproofing was used, and the walls were not plastered. The usual V-shaped horizontal construction joints were used, and at every vertical construction joint the contractor was required to insert a 16-gauge copper strip 10 inches wide with one corrugation at the centre of the joint. These joints were temporarily boxed out into the back-fill to permit of inspection from the outside after the reservoir was filled.

Electrical Distribution

The section in the immediate vicinity of the power house is supplied with electrical energy at 2,200 volts directly from the main station. Beyond this area the supply at the same potential is taken from a sub-station located in the industrial district of the city, about four miles from the generating plant. Transmission is at 13,200 volts. The sub-station is a reinforced concrete building with brick and tile curtain walls and concrete trim. At present it contains three 500 k.v.a. General Electric water-cooled transformers, with the necessary switching equipment. Space is provided for three more transformers, and there is a five-ton hand travelling crane serving the main floor.

In August, 1913, the engineer at the request of the city submitted a report and preliminary plans for a scheme covering the ultimate development of the plant within the limits of the present site. During the preceding year the development of the city had been remarkable, and the very favorable rates quoted consumers for electrical power had minimized the effect the offer of free or very cheap natural gas was expected to have in curtailing the demand on the municipal power plant. Larger sized units were recommended, suitable for a gradual extension of the plant. The ultimate capacities provided for were:—

Filter capacity	30,000,000 gals. a day
Boiler capacity	16,000 h.p.
Turbo-generator capacity .	24,750 kv.a.
High lift pumping capacity	33,000,000 gals. a day
Low lift pumping capacity	55,000,000 gals. a day

The cost of the initial installation was in the neighborhood of $500,000.

Mr. R. S. Lea, M. Inst. C. E., of the present firm of R. S. & W. S. Lea, consulting engineers, of Montreal, was the engineer for all of the work described, which was carried out during the tenure of office of Mr. A. K. Grimmer, Assoc. Mem. Can. Soc. C. E. as City Engineer.

Present-day concentration of business in a small area, stated Prof. George F. Swain recently to the Engineers' Society of Western Pennsylvania in discussing rapid-transit problems in cities, is due to three engineering developments of the last few years, namely, the skyscraper, the elevator, and the telephone. While the development of steel-frame construction for high buildings is what has made concentration of business possible, skyscrapers themselves, he pointed out, would not be practicable without the elevator and the telephone. He cited an investigation made a few years ago by the American Telephone Company as to the relation of the telephone to one of the skyscrapers in New York City. It was found that if all the messages transmitted by telephone to and from the building had to be carried by messengers the entire area of the building would be required for elevators.

Reinforced Concrete as a Building Material

By M. T. Cantell, Lic. R.I.B.A.*

IN view of various statements concerning the advisability of using reinforced concrete for certain buildings which were made before the Public Accounts Committee when inquiring into the construction of the Parliament Buildings, Winnipeg, the following particulars relative to the suitability of this material for general building purposes may be of value to those interested in this class of construction.

Reinforced concrete is a combination of Portland cement concrete and steel, two of the most important materials used for construction. If used separately each has its advantages and disadvantages. If combined, of the right quality and properly proportioned, the resulting material will have the advantages of both and the disadvantages of neither.

Concrete alone has great strength in compression, its crushing resistance when only a month old being approximately 2,500 pounds to the square inch. Its strength increases with age for an indefinite period; whether placed in the air or under water it is practically everlasting; it is one of the best materials to resist heat; if well made it will cost nothing for maintenance; it has perfect sanitary properties, and can be easily moulded to any architectural or engineering forms. Its disadvantages are that it is weak in tension, rarely being able to resist more than 200 pounds to the square inch, and that it lacks ductility. Owing to these defects, it cannot resist the slightest contraction under variations of temperature without developing cracks. Expansion and contraction under variations of temperature take place with concrete as well as with all other materials, although to a less extent than in most others. These cracks entirely destroy the slight tensional resistance the concrete might otherwise offer; consequently, concrete alone can be used only for such structures, or parts of structures, as are in compression. This in many cases necessitates a very large mass of concrete, and consequently a much greater weight and demand on space than is desirable, or at times possible. As an instance of this, take a retaining wall, which if built of plain concrete would need a thickness at its base of approximately half its height, but if built of reinforced concrete the thickness here need not be more than one-twelfth of its height, and perhaps much less, according to the design adopted. Many similar instances could be given. It is obvious, therefore, that a great disadvantage of plain concrete is its bulk and consequent increased cost, weight, and demand on space.

In steel we have a material of great strength in both compression and tension, its ultimate resistance being as much as from 60,000 pounds to 100,000 pounds to the square inch. It is also a material capable of being easily worked or framed into any desired form; but unfortunately its disadvantages outweigh its advantages for many structural purposes. Its strength diminishes with age; this is due chiefly to oxidation, which takes place on exposure to moisture, acids, or general atmospheric action The oxidation is very rapid in structures that are not kept well painted, and it is also very detrimental to the strength of the steel at joints or laps, where it is impossible for paint to be applied. Numerous accidents with great loss of life have been due to this cause. 1-40 inch rust on a bar ¾-inch square will diminish its strength by 13 per cent., or by 20 per cent. on a bar ½-inch square. Another disadvantage of steel is its susceptibility to heat; this it absorbs and conducts rapidly, causing excessive expansion and loss of strength under a high temperature. Steel gains in strength with heat up to a certain temperature, during which time it will expand as much as one-inch in 26 feet. With a continued rise of temperature its strength rapidly diminishes, and its expansion increases proportionately. In ordinary house fires the temperature seldom exceeds 1,000 degrees, but in large buildings it has been known to exceed 2,500 degrees. The expansion, even at 1,000 degrees, causes a stress far beyond the limit for steel at that temperature. Under these conditions the resistance offered by the loads and the fixed ends of steel beams, stanchions and framed structures prevents longitudinal expansion, and causes a stress far beyond what the steel is capable of resisting, especially in its weakened condition. Consequently the beam or stanchion buckles, causing the collapse of the structure. Firemen well know the great risk they run in fighting fires in large buildings in which steel beams and columns are not protected properly. In a recent report made by the Fire Superintendent of the city of London is was stated that this was the greatest danger the firemen had to face.

Newgate Street front of the G.P.O., London, England.

Other disadvantages of steel structures are their high cost of maintenance, and, in certain cases, their unpleasing and fragile appearance, which suggests weakness rather than strength. The latter is particularly noticeable in many of our unsightly, disproportionate bridges, which appear to have been designed for the purpose of obstructing the view or of marring the landscape. It must be admitted, however, that they are useful as landmarks.

In reinforced concrete we have the great strength, toughness, and rigidity of steel, the great durability and fire resisting properties of concrete, the appearance of stability and strength, the steel permanently protected from oxidation, no loss, but an increase of strength with age, a great saving of cost in construction, no outlay for maintenance, and a material adaptable to all forms of architectural and structural work. Since its introduction, experiments have been conducted continuously with a view to obtaining a thorough knowledge of its properties. These experiments, together with the lapse of time and the severe tests to which it has been subjected in existing structures, prove conclusively its absolute reliability for the construction of all types of architectural and engineering structures. It is now used successfully for the construction of all kinds of residences, from workmen's cottages to millionaire's mansions, for small business premises and large skyscrapers, for hotels, churches, theatres, public buildings, hydro-electric power stations, gas works, factory chimneys, reservoirs, aqueducts, water-mains, sewers, grain elevators, bridges, sea defence works, railway works, military fortifications, and numerous other purposes.

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*Author of "Reinforced Concrete."

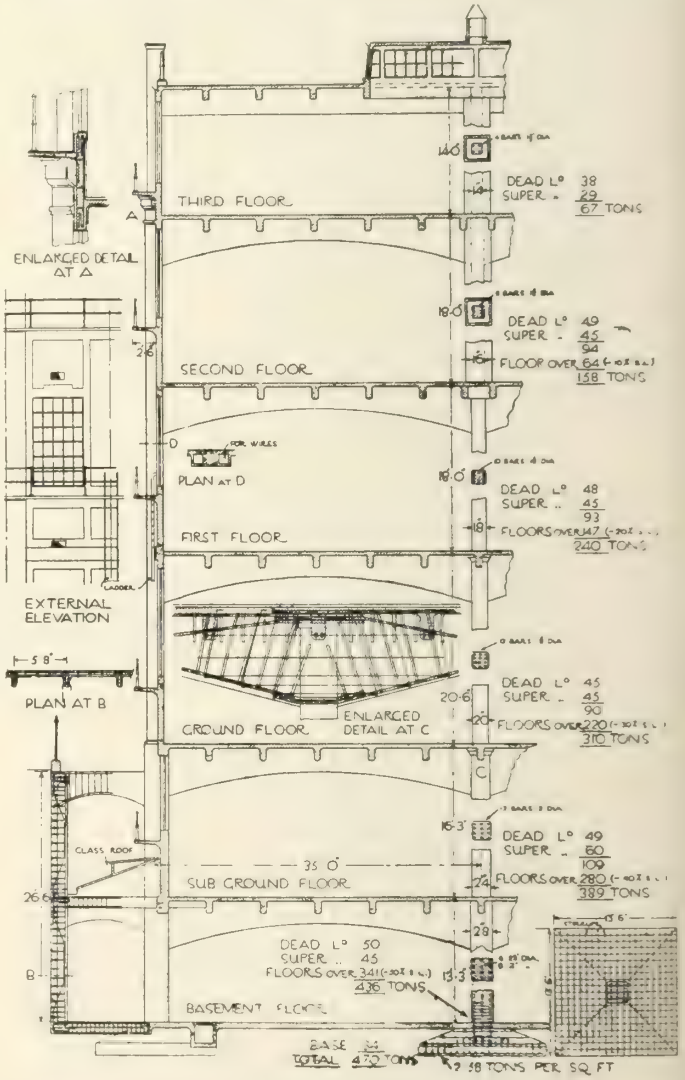
Interior view of the G.P.O., London, England.

In a paper by Mr. M. S. Lang on "Concrete in Railway Work," recently read before the National Association of Cement Users, at Pittsburgh, it was stated that the railways of Canada and the United States found reinforced concrete to be the most durable and economical building material. They were now adopting it for all types of work, including small shop buildings, and even watch-boxes and telephone booths, as these could be constructed of reinforced concrete more cheaply than they could of wood.

It is a method of construction which is fast superseding that of brick, wood, stone, and steel, and is far superior to these in its power to resist water, fire, earthquakes, and atmospheric influence. It is, however, of the utmost importance to bear in mind that of the valuable properties reinforced concrete possesses few will exist if the work is not properly designed and executed. The latter is quite as important as the former, for if the greatest of care is taken with the design and careless supervision is given to the construction the result may be as bad, or probably worse, than if the work were poorly designed. In fact, a poor design well constructed may give a much better result than a good design badly constructed.

The supervision should include careful inspection and testing of all the materials and attention to the preparation, erection and removal of the forms, to the gauge mixing and placing of the reinforcement according to the drawings and specification, to the position and condition in which slabs and beams are left unfinished at the end of a day's work, to the condition of unfinished work before its continuation or completion, to the protection of newly finished work from building operations and inclement weather, and to the testing of work upon completion. All these points are of the utmost importance if we aim at procuring the best results possible. It is absolutely necessary, therefore, that constant and expert supervision be given to the construction.

In designing the chief consideration is strength. This, however, should always be considered in association with economy. This has not been done in the past to the extent it should have been, and the neglect has been very detrimental to the progress of the work. It has given the public the impression that reinforced concrete is more expensive than brick, stone, or steel —which is not the case: its use ensures a great saving of cost on large structures, and also on small ones providing there is sufficient repetition of detail to keep down the cost of form construction. Economy in design, however, has often to be considered from two points of view—viz., the engineering and the architectural; these are not always reconcilable. The most economical engineering structure would have a certain arrangement of beams, slabs, columns, walls, etc., all spaced and proportioned in the most efficient manner, and with a definite percentage of reinforcement, all determined with due regard to the loading, and with a view to obtaining the strongest, most satisfactory, and cheapest structure; but if these engineering points



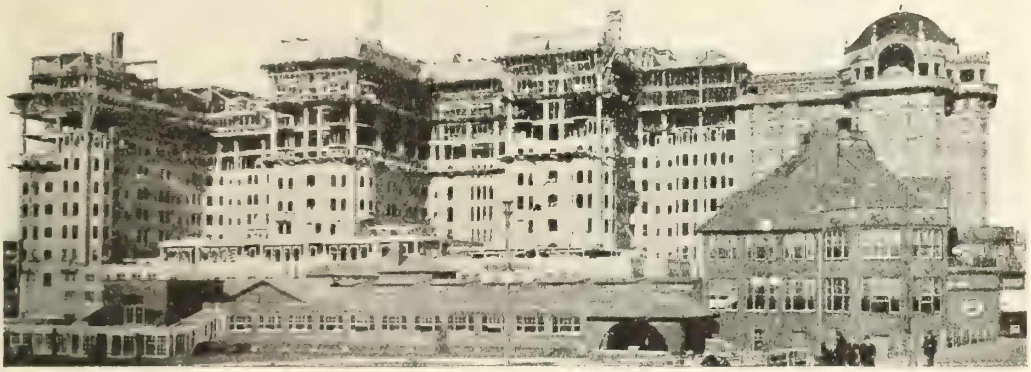
Sectional elevation of the G.P.O., London, England.

were the only ones considered by the architect the result in some cases would be very uneconomical. The engineering structure may be considered either as a plain mass or as a skeleton framework devoid of architectural embellishments. The architectural structure is the engineering structure made more presentable by the addition of fittings and embellishments.

Economy on the engineering side is purely structural, and in a building it is attained by keeping the floor slabs thin, by a free use of beams or columns, and by keeping the beams thin and deep, and also by graduating the columns in size according to their different loads. This, from an architectural point of view, might turn out to be very economical, as it might involve much more finishing in the way of cornices and other details, and much greater expense to secure efficient light and ventilation, than would be the case if thicker slabs with fewer and more shallow beams were used. Therefore, if we wish to design economical structures we must consider carefully the many factors concerned. The most important of these are the ratio of breadth to depth of beams, the percentage of reinforcement, and the general arrangement or layout of beams and columns. These influence all structures, and should be considered by both the architect and the engineer. The percentage of reinforcement is of the utmost importance. Great waste is often occasioned through an excessive quantity of steel being used. There is a definite percentage that will give the most economical section: it is that which is such as to allow both the steel and concrete to be stressed to their allowable limits when the structure is fully loaded; we then get the full value out of each material. If one of the materials is understressed it means that there is an excess of that material, and consequently a waste.

Many examples from all parts of the world could be given as further evidence of the suitability of reinforced concrete for both small and large structures. The following particulars and illustrations, however, should be quite sufficient to substantiate the foregoing statements.

The view shown below of the new Traymore Hotel, Atlantic City, was taken on March 13th of the present year. This building, which is now complete, is one of the largest reinforced concrete structures in existence. It is 520 feet deep and 140 feet wide on the wings. The centre portion is 17 storeys high. At the time this view was taken only 14 storeys had been erected. It contains 634 guest rooms. The exterior facing is brick, to match the terra-cotta of the old wing, to which it is connected, and which is also of reinforced concrete construction, although built some years ago.

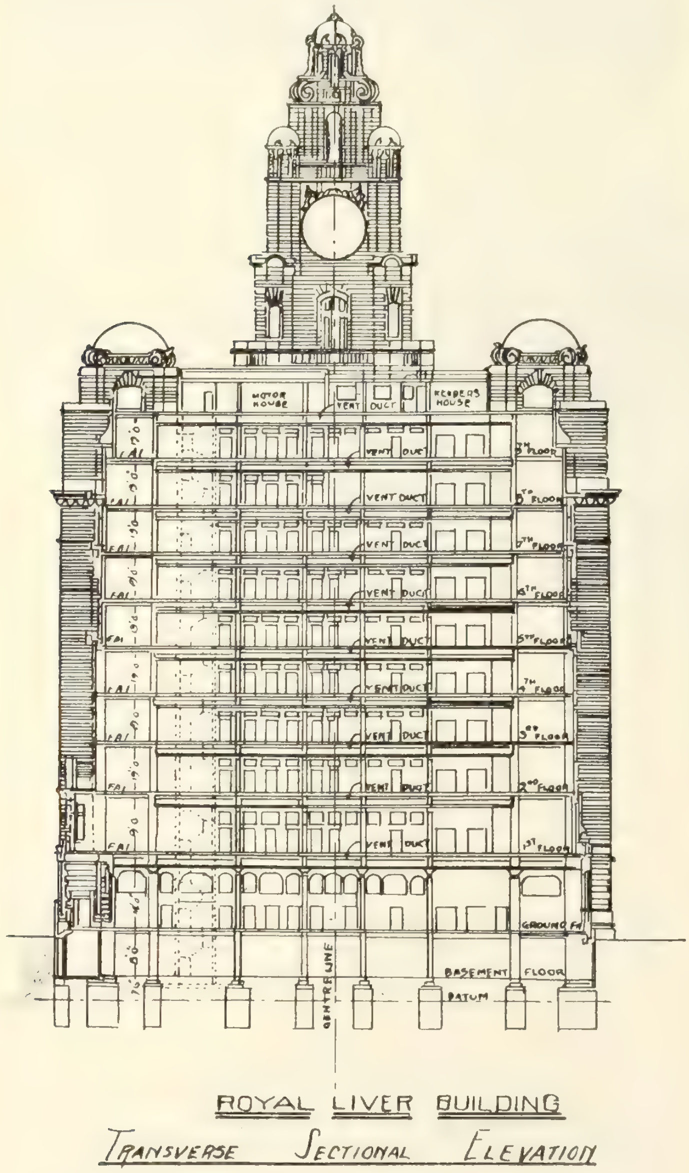

Traymore Hotel, Atlantic City.

The two following structures—the General Post Office in London, Eng., and the Royal Liver Building in Liverpool, Eng.—were referred to in an article recently published in the Manitoba Free Press, regarding the constructional features of the new $4,500,000 Provincial Government Parliament Buildings at Winnipeg. They are, however, worthy of further notice, together with additional illustrations.

The General Post Office, designed by Sir Henry Tanner, in collaboration with Mr. L. G. Mouchel, reinforced concrete engineer, was completed in 1910. At the time of construction it was said to be the most extensive piece of concrete work in existence. A portion of the building is seven storeys high. The dimensions of the basement are 446 by 210 feet. The total floor area is 467,000 square feet—which is about 10¾ acres. The cubic contents of the building are about 9,000,000 cubic feet. The entire structural details, including foundations, walls, beams, floors, roof, staircases elevator shafts, and a furnace shaft 4 feet 6 inches by 130 feet high are of reinforced concrete. The floors are only 3½ inches thick, and are designed to carry a superload of 100 pounds to the square foot. The external wall panels are six inches thick by 34 feet long between the columns; the internal main columns, each supporting 520 tons, are 28 feet high, and vary in thickness from 7 to 8 inches. The subsoil, upon which the reinforced concrete foundation is constructed, is in part hardpan or gravel overlying clay; the remainder being clay, similar to what we have in this province. No caissons were used. In January, 1911, before the Royal Institute of British Architects, Sir Henry Tanner stated that the entire work was thoroughly satisfactory, and that no settlement had occurred, and in strongly recommending that class of construction he said that by adopting reinforced concrete in preference to steel construction they had effected a saving of over twenty per cent., this being the saving originally estimated, the actual cost turning out to be the same as the estimated cost. **The actual structural work turned out at 4½ cents to a cubic foot of the building,** but owing to the elaborate finish the cost of the whole structure was 15⅝ cents to the cubic foot.

Sir Henry Tanner stated further that owing to their test specimens of concrete showing a treble increase of strength in three years since construction they had installed two 1,300-gallon water tanks and a rifle range on the roof and a heavy conveyor on the first floor without strengthening the structure.

The Royal Liver Building upon its completion in 1910 was considered to be the most imposing example of reinforced concrete work in existence. The height to main roof is over 170 feet. The domes of the two main towers are 295 feet above ground level. The total height from basement floor level to top of towers is 320 feet. There are 17 storeys including six in the towers. The location is close to the River Mersey, on a site formerly occupied by the St. George's Dock. On account of this, the soil was of a soft, sedimentary nature, incapable of supporting any appreciable load. Consequently, concrete caissons were adopted and taken down to the sandstone formation, which was found at a depth varying from 32 feet to 47 feet below ground level. The caissons are connected to a reinforced concrete raft, upon which are distributed the loads from the columns, walls, etc. The entire structure is of reinforced concrete, with a granite facing. This facing, however, is not a structural detail; it is supported at each floor level by the reinforced concrete frame. The designing involved unusual and difficult constructive problems, necessitating beams for spans of from 50 to 60 feet, to carry 1,600 tons concentrated at two points in addition to a distributed load of over 100 tons, as well as columns to support loads of 1,600 tons. I understand that the whole work has proved entirely satisfactory, and that the building is a striking monument to the possibilities, advantages, strength and economy of reinforced concrete.



Sectional elevation of the Royal Liver Building, Liverpool, England.

The Royal Liver Building, Liverpool, England.

Dynamite cartridges should never be broken in two, according to the "DuPont Magazine." This dangerous practice is forbidden by law in many countries. Hardly a winter passes without some blaster being killed by breaking a dynamite cartridge. When the dynamite must be exposed, the cartridges should be slit lengthways with a sharp knife. Another dangerous practice indulged in by many rock men is that of carrying matches in their clothes for lighting their pipes, blasting fuses, etc. Instances are on record of an entire loading gang being killed from an explosion caused by dropping a match from one of the men's pockets into the hole, causing the blast to go off while it was being tamped. If fuses are lighted with matches, one man should have charge of them and leave them at a safe distance while loading the hole.

A steel flat-car for whales has been built for the South African Railways by the Leeds Forge Company, of Leeds, England. As described in London "Engineering," the car has a capacity of 160,000 lbs., and the weight of the car itself is 74,700 lbs. The most remarkable thing about the car is that, although it is designed to run on a narrow-gauge road of 3 ft. 6 in. gauge, the width of the car body is 12 ft. 6¼ ins. The whales are brought to port near Durban, South Africa, and are loaded on these special cars for haulage to a factory a few miles away, where they are cut up for rendering. It is evident that cars of such extraordinary width could not run in general traffic on account of clearance limits, even on standard-gauge lines. Their use on a narrow-gauge road shows the possibilities in increasing the width of rolling stock where clearance restrictions do not apply.

The Economics of Sewage Filters[*]

SEWAGE filters may be divided broadly into three classes: (1) Intermittent sand filters or their equivalent. These consist of a body of sand or fairly pervious material of other kinds. The sewage is distributed over the surface of this porous material, and at the bottom the filtered sewage is collected in underdrains. In order to get the benefits of oxidation in the pores of the sand bed, the application of the sewage to the filter is intermittent, with periods of rest and aeration.

(2) The second type is the so-called "contact" filter. This consists of a body of practically any thickness of stone or equivalent material, such as large-sized gravel, pieces of porcelain, brickbats, cinders, or almost any coarse-sized granular material. The sewage is applied to such a filter either from the bottom or from the top, so as to fill the bed. The sewage is allowed to stand in this filter bed for a given time. It is then discharged and the empty bed is allowed to stand for a period.

(3) The third type is the so-called "sprinkling" filter. This consists of a body of stone of a minimum depth of 5 ft., on which the sewage is sprinkled or sprayed and spread by nozzles and distributed in small quantities so that the sewage trickles down over the stones and is collected at the bottom.

All three types of filters effect the purification of the sewage in the same way. Through the action of the bacteria present in the filter bed the sewage is to some extent oxidized and the organic matter is broken up. Unstable forms of matter are changed into more stable forms. While the exact form of action is unknown, it is believed that the three types of filters act in the same way, and the difference is rather a mechanical one of form of application, rather than one of principle of action.

Performance of Filters.—The output of a filter of any type, measured at any suitable purification unit, is largely a question of local conditions. It depends upon the nature of the sewage, the nature and fineness or coarseness of the filtering material, the method of application of the sewage to the filtering material, temperature, atmospheric conditions, and many other factors. The intermittent sand filter is best used when it is desired to have a very high degree of purification. The other types, the contact filters and sprinkling filters, are used for a rather lesser degree of purification. It is to be understood that the rate of application of the sewage to the various types of filters must be properly proportioned to the ability of these filters to take care of the sewage. By using a suitable rate under suitable conditions any type of filter can be made to give any degree of organic purification that may be desired.

Rate of Application of Settled Sewage to Filters.—The question of the rate of application of sewage to a sand filter is largely tied up with the question of preliminary treatment in the way of tankage or screens. The writer's book, "Sewage Disposal," gives for several cities in Massachusetts the population whose sewage can be treated per acre of filter bed, and the time of detention in preliminary sedimentation tanks, sortage wells, pump wells, or other means of storage. These figures are not to be taken to represent present conditions.

	Period of Detention, hours.	Population per acre of filter.
Andover	1½–3	950
Brockton	12	1,160
Clinton	12	425
Framingham	12	375
Gardner (old)	1½	1,310
Gardner (new)	1½	2,000
Pittsfield	12	605
Stockbridge	8	220
Worcester	1½	1,390
Average of all	6.7	937

The Baltimore Sewerage Commission in 1906 estimated that, using a sand filter with 3 ft. of clean sand over the gravel, an allowance of 150,000 gals. of 6-hour settled sewage per acre in 24 hours, corresponding approximately to 1,200 people per acre, would be a proper rate.

Data for contact filters are relatively scant from American practice, and while many English data are available, the differences, owing to the difference in the strength of the sewage, makes such data rather dangerous as a basis of comparison.

A series of experiments in Columbus, Ohio, indicated that 5-ft. deep stone filters, on the contact principle, could safely be operated at an average rate of from 600,000 to 700,000 gals. per acre per day. Reducing this to a 4-ft. depth will give about 500,000 gals. per acre per day, which, on the basis of 100 gals. per capita per day, would give a loading of approximately 5,000 people per acre of stone bed.

A series of tests made at Lawrence on contact beds of various depths from 24 ins. up to 18 ft., showed an average output of some 700,000 gals. per acre per day for a depth of stone on an average about 5½ ft. This is equivalent to an output of about 135,000 gals. per acre for each foot of depth of stone, or, for a 4-ft. depth of bed again, is equal to about 500,000 gals. per acre per day, or say a loading of about 5,000 people to the acre.

The contact filter installation at Plainfield, N. J., with 3.6 acres of stone bed 4½ ft. deep, gave in 1910 an output on an average of 1,700,000 gals. of sewage a day. On the basis of an allowance of 100 gals. per capita per day, this will correspond with a 4-ft. bed, to about 4,200 people per acre of filter.

For sprinkling filters much more satisfactory data can be had. Sprinkling filters have been used very extensively in this country of recent years, and their ratings can be fixed with a good deal more dependence than is the case with contact filters. A list of a number of plants or projected plants giving the depths of the stone bed of a sprinkling filter and the loading in population per acre follows:

	Depth of stone in feet.	Population per acre of bed
Atlanta	6	20,000
Reading	5	18,000
Columbus	5	18,000
Baltimore	9	20,000
Montclair	7½	15,000
Philadelphia	6	20,000
Fitchburg	10	20,000
Mount Vernon	8	24,000

The average of all these shows a 7-ft. deep bed and an average loading of 19,400 population to the acre.

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[*] Paper by Mr. George W. Fuller, presented before the annual convention of the American Society of Municipal Improvements.

Not considering special conditions, and just taking fair figures, we may safely state the following:

Intermittent sand filters, 3-ft. bed of sand, loading 1,000 population per acre.

Contact filters, 4-ft. depth of stone, loading 5,000 population per acre.

Sprinkling filters, 7-ft. depth of stone, loading 19,000 population per acre.

The rates of loading, then, for these three types of filters, are in the ratio 1, 5, and 9.

Cost of Sewage Filters.—Costs of construction are so much affected by local conditions, such as the amount of excavation necessary, the cost of various classes of materials, the distance from which various classes of materials must be obtained, details of local construction conditions, such as competition, class of work required, and others, that comparative costs for different localities are only to be used with great discretion, and individual cost and even averages are only a guide to comparative costs in various places. Having this limitation in mind, we will examine in a rough way the cost of various types of sewage filters on the per capita basis.

The average cost of the nine Massachusetts intermittent sand filters cited above is $3,260 an acre, as reported in the Massachusetts State Board of Health Report of 1903. This gives a cost per capita connected to the filters of $3.50.

The 1906 Baltimore Sewerage Commission estimates the cost per acre of filters at $6,350, these filters being suitable for a connected population of 1,200 to the acre. This corresponds to a per capita cost of $5.30.

The cost of contact filters, varying, of course, with the degree of the fineness of the design, may be taken, for filters equipped with suitable convenient appurtenances, at $30,000 an acre for a 4-ft. deep bed. This corresponds with a loading of 5,000 population per acre to a per capita cost of $6.

For sprinkling filters 7 ft. deep the cost will be about $45,000 per acre. On the basis of a loading of 19,000 population per acre, the cost per capita will be $2.37.

When considering the relatively low cost of the Massachusetts sand filters compared with the estimate made of the Baltimore sand filters, it is to be borne in mind that the conditions in Massachusetts for the construction of sand filters were unusually favorable and do not represent average conditions through the country. In most places the costs would approximate more nearly those estimated for Baltimore.

Taken in a broad way, sprinkling filters are a far more economical installation in the matter of first cost. Intermittent sand filters and contact filters do not stand far apart in this particular.

Relative Costs of Different Depths.—There is not very much known about the relative advantages of filters of shallow or deep construction. The choice of depth is usually made for entirely different reasons from those of obtaining the most economical construction to obtain the desired amount of purification. Very few tests of a comparative kind have been made to give convincing information, and the interpretation of the tests has not been uniform. In some places the conclusion has been made to make filters, say, 10 ft., at other places 6 ft., and some study is worth while to determine what, if any, difference there is in the cost of such construction at different depths, and which would appear to be the better. It is to be assumed in such comparisons that sufficient head would be available in any case for the greatest depth to be considered, and that pumping would not be necessitated by building filters of the greater depth.

For intermittent sand filters questions of depth do not arise. The filters are generally made as shallow as is consistent with getting proper results, and sand beds are not usually made more than 4 or 5 ft. deep as a maximum. Shallower beds, even, will give about the same output as the deeper beds, and beds are made deep only so that sand may be removed for cleaning without removing the sand for any considerable period.

With contact filters it is recognized that from the nature of the action of the contact filters, where the amount of air that is drawn in between fillings of sewage is practically equal to the volume of the sewage, and where surface clogging cannot be a serious factor and may even be no factor at all, each unit of volume of the stone forming the filter, say each cubic yard, will give the same output of sewage purification, no matter what may be the depth of the filter.

From this it follows that it is economical to build a sewage filter on the contact principle as deep as local conditions of construction will permit, and the limitation of depth which it is economical to use is therefore made by the factors of earth excavation or fill and the possible head available without pumping.

When it comes to sprinkling filters the problem becomes a little more complicated. The English experience, as recited in the Report of the Royal Commission, seems to indicate that the output per unit of volume of sprinkling filters is the same, no matter what the depth. Our experience in work in this country does not wholly corroborate this information. Our best knowledge seems to indicate that the output per unit of volume of sprinkling filters is somewhat less for deep filters than for shallow filters. For such conditions, with a relatively decreasing efficiency of the stone of the filter beds for greater depths and at the same time a relatively decreasing cost per unit volume of the stone for deep beds, there must come some point where the greatest output per unit of cost will be obtained.

The Report of the Baltimore Sewerage Commission for 1911 gives some information obtained from tests made in Baltimore as to the relative efficiency of various depths of broken stone of sizes of 1 to 2-in. stone, which is the one most commonly used. Figures obtained from that source are as follows:

	Depth of Bed.		
	6 ft.	9 ft.	12 ft.
Relative stability	79	87	89
Per cent. reduction of oxygen consumed.	56	70	72

Giving equal weight to the relative stability and per cent. reduction of oxygen consumed, we get the following:

	Depth of Bed.		
	6 ft.	9 ft.	12 ft.
Relative stability	1	1.2	1.23
Per cent. reduction of oxygen consumed.	1	1.25	1.28
Average of the two	1	1.22	1.25
Relative depths	1	1.33	2.00
Relative value of stone per cubic yard ...	1	.92	.63

Assuming that this depth varies at a uniform rate from one end of the curve to the other, we get the following for the relative value of stone per cubic yard:

Depth of bed in feet ...	6	7	8	9	10	12
Relative value of stone per cubic yard	1.0	0.97	0.94	0.92	0.82	0.63

To get comparative figures, then, between the 6, 8 and 10-ft. beds the cost figures for the 8-ft. beds must be divided by 0.94, and the cost for the 10-ft. beds by 0.82, putting them all on the basis of the 6-ft. beds.

For comparative cost a number of factors, such as excavation, etc., are naturally omitted, as they are not affected in all places in the same way by the depth of the filter. Comparing, then, only those particular costs which are affected per unit of output by the depth of the filter, we get the following:

	Per effective cu. yd. depths.		
	6 ft.	7 ft.	8 ft.
Floor—Take at 40c. per cu. yd. for a 6-ft. bed	$0.40	$0.35	$0.32
Tile—Take 11c. per sq. ft. for any depth	.49	.44	.40
Walls—Assume cost 17c. per cu. yd. for 6-ft. depth	.17	.17	.18
Galleries and Collectors—Assume for 6-ft. depth 25c. per cu. yd.	.25	.22	.20
Distribution—Assume 50c. per cu. yd. for 6-ft. depth also. As costs theoretically vary only according to quantity delivered, they must be same for all effective depths per cu. yd.	.50	.50	.50
Stone—Assume $1.50 per cu. yd.	1.50	1.55	1.60
Total	$3.31	$3.23	$3.20

Outside factors will depend on quantity only, and not on depth.

It appears, then, that there is some slight saving of cost, which, on the figures given in the above tabulation, amount to about 3 per cent. in favor of the 8-ft. deep bed as compared with the 6-ft. deep bed. On the other hand, it is to be recognized that a deep bed will give a good deal more trouble with pooling and freezing than a shallow bed, and the advantages in favor of a shallow bed due to this lesser amount of pooling will be considerably more than this 3 per cent. difference in cost. Taking everything into account, the writer believes that a sprinkling filter of not less than 6 ft. and not more than 7 ft. in depth will in the greater number of cases prove the most economical to use.

Comparative Costs of Trench Sheeting

By Richard T. Dana[*]

FOR sheeting those of the trenches under consideration which were excavated by the steam shovel, Wemlinger sheet steel piling, section 2a, No. 12 gauge, was purchased, the intention being to drive the sheeting ahead of the shovel with a McKiernan hammer, and excavate on the inside. As the operation of the shovel was not economical, this plan was abandoned, and the sheet piling was used in the hand dug trenches, together with the lumber purchased for that purpose.

Extensible steel trench braces were used chiefly, but sometimes wooden braces, either cut from the woods or made of broken ranges, were employed.

The cost of sheeting the sides of a trench per linear foot depends on (1) the closeness of the sheeting—that is, whether the sections or planks are driven close together or spaced varying distances apart; (2) the skill of the workmen; (3) the urgency of the work; (4) the hardness of the material; (5) the depth driven; (6) the method of driving; (7) the kind of sheeting, whether wooden or metal; and (8) the kind of bracing.

In cases of badly caving banks or running sand absolute continuity of sheeting is necessary, but where the banks are firm, even though the trench be deep, the sheeting need only be used as a safety measure and the sections placed 3 ft. or more apart.

The most intelligent men should be chosen for the sheeting, as a single bad cave-in may wipe out the profit on a job and cause serious injury or loss of life. The head sheeter should be an active man, while his helper should be a heavy, strong laborer. Their pay should be more than that of the pick and shovel men. In trenches of this character the sheeters are seldom worked to their full capacity, as work of this kind requires a certain minimum number of men and their day's work depends on the performance of the rest of the gang. Therefore the costs given in the tables do not, in most cases, truly represent the minimum cost.

Where the material is hard and strong metal sheeting penetrates more readily than wood, and in running sand or water the lap and clips on the metal sheeting make it very efficient in keeping the trench clear. However, the first cost is greater, and on work of short duration it is not economical, unless the sheets can be used on another convenient job or sold advantageously. The weight of a square foot of this section is about 7½ lbs., which makes it more difficult to handle than the wood planking 2 ins. thick, which weighs about 5 lbs. the square foot. Steel extension braces are invariably more economical than wooden braces when the trench is narrow; the cost of placing them is much less. Wooden braces require measuring, sawing, and wedging, while the same jacks may be used on several different widths of trench.

Some thirty sets of observations were made and separated into two classes—close and spaced—each of these being divided into three classes—mixed, wood, and metal—for sometimes the wood and metal sheeting were used in the same trench as they came to hand. The rate of pay for sheeters was about $2.50, and that of the helpers about $2. Other labor received about $1.65. Overhead charges have been taken account of by including one-eighth of the pay of foreman and waterboy, which were $4 and $1 a day respectively.

Cases 7, 8 and 9 give the cost of removing the sheeting. Case 9 is peculiar. This occurred in sheeting a trench through loose sand in which a 42-in. concrete sewer was to be laid. The metal sheeting was driven about 6 ins. below the bottom of the trench, and after being oiled was used as the outside forms for the concrete sewer. When the concrete had set and the trench had been backfilled within 2 ft. of the top, the sheeting was withdrawn. A large wooden tripod with a differential block and tackle operated by two men had to be used for pulling the sheets. The average time for pulling one sheet on the day the third observation was made was 9 min, 53.3 sec., made up of the following items:

Item	Min.	Sec.
Loosening with mallet	..	18.6
Moving along chain hoist	..	40.0
Lowering hook and chain on hoist	..	43
Placing hook on sheeting and starting to pull	1	14
Raising sheeting	5	30.5
Removing hook from sheeting and putting sheeting aside	..	44
Miscellaneous	..	43.2
Total	9	53.3

Sheeting being on both sides of the trench, and two pieces of sheeting being equal to 1 ft. of trench, the time for each foot of trench was 19 min. 46.6 sec.

The number of feet of trench from which the sheeting was removed each day was about 30.4. The cost was as follows:

2 laborers, at $1.65	$3.30
⅛ foreman, at $4	.50
⅛ waterboy, at $1	.13
Total cost per day	$3.93

Cost per linear foot (30.4 ft. removed), 12.9 cents.

In case 8 the foreman and waterboy are not

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[*] Consulting Engineer, New York City.

Table 1—Sheeting Trench—Unit Costs and Other Data, for Wood, Metal and Mixed Sheeting, When Solid and When Separately Spaced

No. Obs.	Unit cost, cents		Trench depth, ft.	No. men	Equivalent 10-hr. performance, lin. ft. of trench	Remarks
	Lin. ft.	Sq. ft.				
Case 1—Mixed Sheeting, Solid						
1	7.23	0.344	12	3	91	Sandy
2	8.00	0.620	6.5	4	100	Material caves badly
3	8.30	0.670	6.5	4	100	Clay and sand
4	8.61	0.480	3	2	60	Soil, poor sand
5	9.50	0.530	9	2	55.7	Soil, poor sand
6	10.50	0.704	7.5	4	80	Soil, clay gravel
Average	8.69	0.558	7.4.	3	81.1	
Case 2—Wood Sheeting, Solid						
1	7.80	0.390	10	3	98	Material sandy
2	8.00	0.450	9	2½	67	Clay material, some sand
3	8.55	0.710	6	3	75	Clay gravel
4	14.80	0.930	8	3	63.3	Very sandy; sheeting 8 ft. x 8 in. x 2 in
5	14.90	0.530	14	2	36	Soil, a poor sand
6	19.50	1.150	8.5	3	31.4	Soil, sandy
Average	12.26	0.693	9.25	2.7	61.8	
Case 3—Metal Sheeting, Solid						
1	9.10	0.350	10	2	62.5	Soil very sandy
2	9.40	0.360	13	2	61	Soil very sandy
3	9.60	0.368	13	2	60	Soil very sandy
4	11.00	0.610	9	3	70	Soil good sand
5	16.00	0.755	11	3	44	Soil sandy
6	18.50	1.020	9	4	54	Sand tending to cave in.
7	22.40	1.250	9	3	37½	Good sand
8	24.30	1.520	8	3	38½	Very sandy, caving
Average	15.0	0.779	10.25	2.7	53.4	
Case 4—Mixed Sheeting, Separately Spaced						
1	4.78	0.240	10	2	125	Soil a poor Sand
2	6.54	0.356	9	4	100	Soil clay and gravel
Average	5.66	0.298	9.5	3	112½	
Case 5—Wood Sheeting, Separately Spaced						
1	4.20	0.320	6.5	2	88½	Sections spaced 3 to 6 feet apart.
2	4.40	0.244	9	2	129	Soil poor sand
3	5.20	0.290	9	2	15	
Average	4.60	0.284	8.17	2	77.5	
Case 6—Metal Sheeting, Separately Spaced						
1	1.90	0.150	6.5	2	194	Sections far apart
2	3.10	0.195	8	2	162	Sections far apart, clay and sand
3	3.12	0.169	9.3	2	180	Sections far apart, clay and sand
4	4.06	0.232	9	2	137	Sections far apart, clay and sand
Average	3.04	0.186	8.2	2	168	

Table 2—Removing Sheeting—Unit Costs and Other Data for Wood and Steel Sheeting, Solid

No. Obs.	Unit cost, cents		Trench depth, ft.	No. men	Equivalent 10-hr. performance, lin. ft.	Remarks
	Lin. ft.	Sq. ft.				
Case 7						
1	0.32	0.024	6.5	2	11.61	Wooden, spaced 3 to 6 ft. apart.
Case 8						
1	1.1	0.042	13	2	3.00	Wooden sheeting blocked partly with wood and partly by jacks. Sheeting, solid. Soil a clay and poor sand. In unit costs given only direct labor is taken account of, i.e., foreman and waterboy are not included.
2	1.6	0.062	13	2	2.50	
3	2.2	0.084	13	2	1.50	
4	2.5	0.096	13	2	1.66	
5	2.6	0.100	13	4	2.50	
6	2.7	0.135	10	2	1.25	
7	2.7	0.135	10	4	2.50	
8	2.8	0.140	10	2	1.25	
9	3.3	0.137	12	4	2.00	
10	3.5	0.175	10	2	1.08	
11	3.6	0.180	10	2	0.94	
12	3.9	0.177	11	2	0.83	
Average	2.7	0.122	11.5	2½	1.75	
Case 9						
1	5.6	0.311	9	2	0.70	Sheeting, steel, filled in to a depth of about 6 ft. before pulling. Used a differential block and tackle. Overhead charges, ⅛ foreman and ⅛ waterboy included.
2	12.5	0.695	9	2	0.31½	
3	12.9	0.718	9	2	0.30	
Average	10.3	0.575	9	2	0.44	

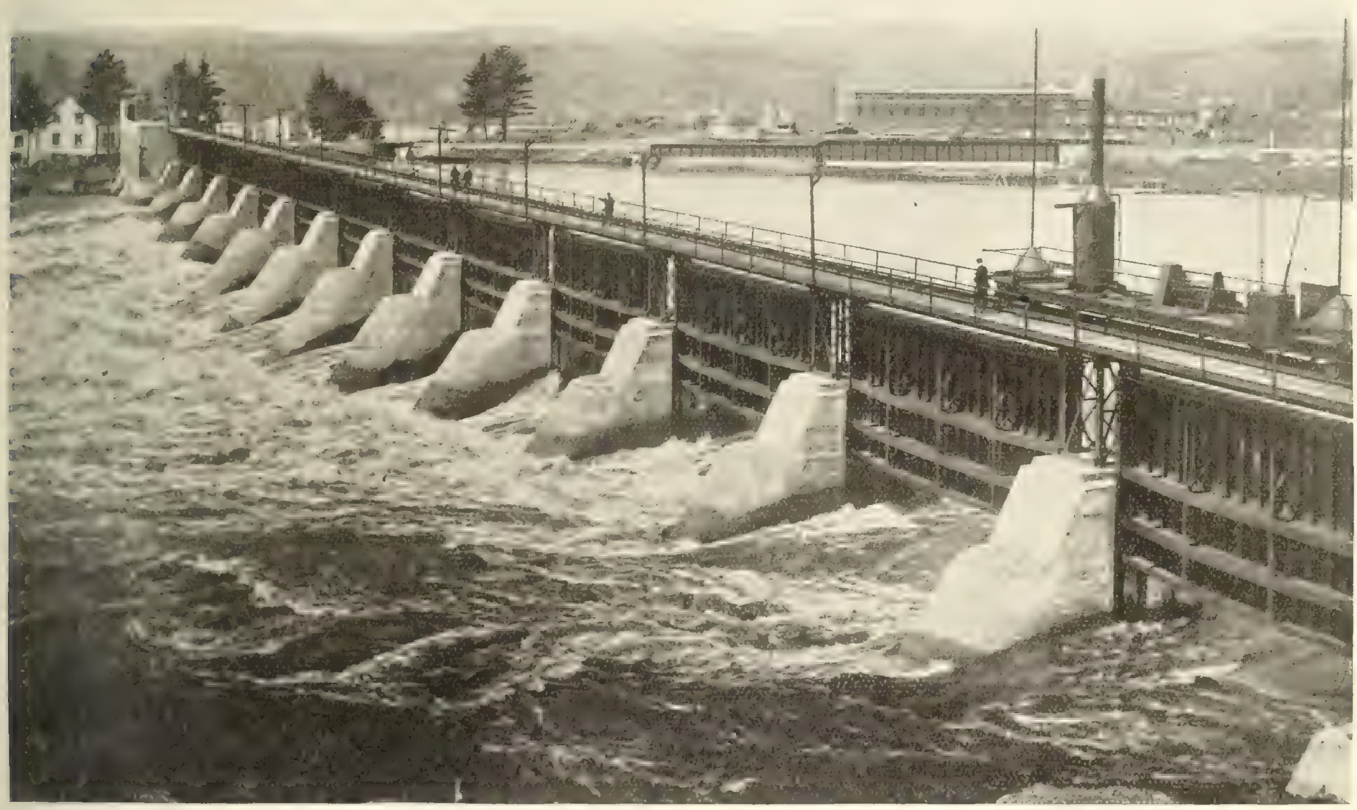
charged. If this were done the average cost would be about 3.2 cents.

At the beginning of the season 400 pieces of Wemlinger piling 10 ft. long and about 5,000 ft. b. m. of 2 x 8-in. longleaf yellow pine were purchased. The steel piling cost 28 cents a superficial foot, and the lumber cost about $34 a thousand. This does not include the timber rangers which were used for both steel and timber sheeting.

At the end of the season there remained 1½ dozen planks and some 20 ranges, all of the Wemlinger piling and all of the iron braces. The timber had been stolen, broken, burnt, or otherwise wasted, or in a few cases used for other purposes. During the summer the steel sheeting was repeatedly used for roadways in and out of sand pits and wherever the hauling was bad. During the fall and winter it was used to heat the concrete for the buildings under construction, the sections being laid at an angle of 30 deg., so that one end rested on the ground and the other on a wall of building blocks or brick. Some of the wooden sheeting, in spite of hard usage, remained in fit condition to be used many times, and in fact seemed almost indestructible.—Engineering Record.

Regulating Gates at Shawinigan Falls, Que.

THE accompanying illustration gives a general view of one section of a movable steel dam built for the Shawinigan Water and Power Company at Shawinigan Falls, Que. This dam consists of two portions, as the river is divided into two channels by an island. One portion consists of eight gates, and the second portion, which is the one illustrated, consists of twelve large and two small gates. All the large gates are 40 ft. wide in the clear between piers, 18 ft. high, and 21 ft. lift. The small or regulating gates are contained in the gate house. They are 16 ft. wide and 18 ft. high, with 21 ft. lift. The large gates are lifted by means of travelling hoists which run along the bridge, which is supported by towers on the masonry piers. Hoisting is done by means of screws which connect with the vertical end girders of the gates. When lifted to their highest position, the gates are sustained by being connected directly to the bridge through locking pins, which are operated by a hand lever from the platform of the hoist. The hoisting screws may be disconnected and the machine used for lifting other gates. In the illustration all the gates are lifted to their highest position. Two hoists are provided for the 12-gate section of the dam, and one hoist for the 8-gate section, all of which are operated electrically. The boiler shown in the illustration on the platform of the hoist is used for freeing the gates of ice when this becomes necessary. The small gates in the gate house are provided with individual screw hoists of a type similar to those mentioned.



Section of a movable steel dam built by the Dominion Bridge Company, for the Shawinigan Water and Power Company.

Connecting a Suction Tunnel

IMPROVEMENTS made to one of the pumping stations of the Chicago Water-works included the construction of a suction shaft and tunnel and the connection of the latter to a wet well in use. Engineering and Contracting published the description of the methods of handling the work from the annual report of the engineer of water-works construction, Mr. H. W. Clausen.

The construction of a suction shaft and tunnel and the connection of the latter to a wet well in service were special features involved in the improvements made in 1913 to the Springfield Avenue Pumping Station of the Chicago Water-works. The present article describes the method of handling this work.

The work was made necessary by the installation at this station of a new Allis-Chalmers 25,000,000-gal. turbine-driven centrifugal pump. The city provided the foundations for the pump and also the suction shaft and tunnel to a connection with the wet well which supplies the four other pumping engines in operation in this station.

The method employed for the connection of the new suction tunnel to the station wet well consisted in placing a curved cast iron shield in the wet well. The edge of this shield was grooved and fitted with a 2½-in. rubber fire hose, acting as a gasket to permit a water-tight connection between the shield and the masonry wall of the well. On the upper end of the shield were two flanged connections, one for the 8-in. pipe extending to the level of the gallery on the top of the wet well at an elevation plus 8, and the other for a 24 in. pipe extending to a point just below a 24 in. horizontal suction pipe, which supplemented the main suction of old pumping engine No. 4. It was expected that the head of water caused by pumping the water out of the shield through either one of these pipes would give a pressure sufficient to hold the shield in place. The empty space between the shield and the wall would then give opportunity for making a connection between the old brick masonry of the well and the new concrete lining of the tunnel.

The material underlying the foundations and pit floor of the pumping station is solid rock. It was therefore necessary to blast out the shaft and tunnel. The foundations of engines previously erected, between which the shaft and tunnel were built, are 20 ft. apart, and rest directly on the rock. Both of these pumping engines were to be kept in continuous operation, and extreme precautions were necessary.

Work was started at the station on May 12. The excavation for concrete footings for the pump and discharge pipe pier was carried to rock at an elevation of about minus 20.5. The rock was cleared with picks to a level surface to minus 21.75. The foundations were erected of 1:2:4 concrete. Forms were made of 2-in. lumber, and bolted together so that they could be used for similarly designed foundations elsewhere.

Drilling for the shaft blasting was started by hand on May 20, and by machine on May 31. The work of drilling, blasting and mucking was carried on from May 22 to July 8. Two hundred and ninety 1 x 8-in. sticks of 60 per cent. dynamite, and 568 electrical exploders, were used on this part of the work. The blasting was stopped at a point 5 ft. from the interior surface of the well, leaving 2 ft. of rock and 3 ft. of masonry to be taken out. About 80 holes 12 ins. deep were drilled in the face preparatory to the work of removing the last 5 ft., which was to be done after the placing of the tunnel shield.

The tunnel shield was made of cast iron, approximately rectangular in shape, about 8 ft. 7 ins. high. 6 ft. 9 ins. wide, and 3 ft. through. The casting was made in the foundries of the American Brake Shoe and Foundry Company. The hose gasket was a piece of condemned fire hose with the usual canvas lining, and was filled with a special preparation, called "chemical rubber," which is being used as a filler for automobile tires. The gasket was held in place with T-headed bolts, the heads of which were inserted in the lining, the shanks extending through to the outer surface of the groove, where they were held in place with nuts.

On August 27 the shield was lowered into the well, with the 24-in. spiral pipe attached, using the station crane. It was suspended from two 1¼-in. cast steel locomotive cables, which in turn were suspended from two 3-ton chain falls. These were suspended from 6 x 8-in. timbers supported on the gallery and upper edge of masonry of the well.

A No. 4 drive well jet pump, with 1-in. steam supply, was placed inside of the shield, with the bottom at elevation minus 32, the discharge passing up over the top and down the side of the well, and discharging at about elevation minus 13. The suction of a No. 3 Blakeslee bilge pump was also lowered into the shield through the 24-in. pipe.

The two pumps, with a combined capacity of 83 gals. a minute, did not lower the water inside the shield sufficiently, proving that a larger pumping capacity was necessary to force the shield and gasket tight against the masonry wall.

A No. 2 double-cylinder Emerson pump was added on September 3, placed in the wet well, and connected to the steam line. The 3-in. suction of this pipe was let into the 24-in. pipe. The operation of this pump produced the desired effect of tightening the shield, emptying the same to the limit of the suction in about five minutes. The shield proved to be tight on September 8, and the blind flange was placed on the 24-in. pipe leading up from the shield. This was necessary, as the water level in the well was above normal, pumping engine No. 4 having been shut down. Consequently the deep well jet pump, which was operated intermittently, took care of all the leakage. The leakage was steadily reduced, requiring about 2 minutes of pumping every 15 minutes at first and 20 seconds of pumping every 20 minutes toward the completion of the work.

The plans for the installation of the centrifugal pump provided for a 36-in. hydraulically operated gate valve, to be placed in valve pit just below the floor level of the main engine pit. The shaft and tunnel were lined to an average thickness of 6 ins. with 1:2:4 concrete and the valve placed and connected, giving an additional safeguard in the event of an accident occurring.

The first foot of rock of the two remaining was mined out by blasting, using 19 sticks of dynamite in 62 of the holes previously drilled. The rest of the rock and the brick work, varying from 3 ft. to 4 ft. in thickness, was mined by drilling holes and breaking out material with bull points and sledges. All mining was completed by September 17.

The remaining portion of the tunnel was then lined with concrete of minimum thickness of 4 ins., the average thickness being 8 ins. The lining was completed on September 18. Forms were removed and water admitted into the tunnel on September 22. The emergency pump, tunnel shield, and concrete chute were then removed from the station. The wet well cover and railing were replaced, and the interior of the station cleaned up.

New Connaught Library at Victoria, B.C.

THE new Provincial Library addition to the Parliament Buildings at Victoria was practically completed several months ago, but owing to delay in the arrival of some of the interior fittings the building was not ready for occupancy until June 10th.

The Library, the corner-stone of which was laid in August of 1912 by His Royal Highness the Duke of Connaught, is a handsome building and a worthy addition to the block of legislative structures of which British Columbians are justly proud. It faces on Superior Street, is immediately behind the legislative wing of the existing building, and, although of a somewhat different style, is in harmony with it. The block stands three storeys high from the Superior Street frontage, with a high basement. In niches below the tops of the corner towers are full-length statues of men prominent in the history of the province since its Crown Colony days, and above are several symbolical figures.

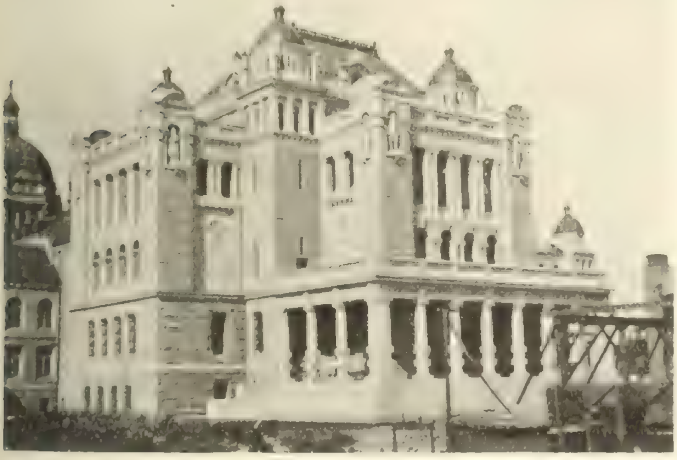
The main portion of the Library is on the same floor as the Legislative Chamber, and is approached from the lobby of the house by a wide corridor which occupies the place of the old rear entrance stairs. The office of Librarian E. O. S. Scholefield is to the right and that of his assistant to the left, before the rotunda is reached. The rotunda runs up through two storeys, and is domed, with gallery openings on the second floor. It is octagonal in form, with columns in pairs at each side of the four openings, and the walls panelled in marble. The veining of the marble corresponds in all four walls. At the base of each is a wide marble pedestal for statuary. The floor is of marble tiles in color.

Mahogany Finishings

On the west side of the rotunda is the reading room, and on the east is the reference room. Both are finished in mahogany, are high-ceilinged and spacious, and admirably adapted to their uses. In the reading room is a quantity of exquisite carving in holly, which will harmonize with the darker background when it has weathered somewhat. This was executed at Cheltenham, England, and is a triumph of the wood-carver's art. Interlaced in the patterns are animals, birds, flowers and fruits of the province. Over the mantel there is a festoon of this carving, and other bits are placed on the upper halves of the pilasters around the apartment. The fireplace in the reference room is built in hearth style, and the mantel is carved in simple designs.

The delivery clerk's desk is on the south side of the rotunda, and immediately behind it are the stackroom and the dumb-waiter which communicates with each storey of the six in the stack. The furniture in all the rooms is of mahogany, upholstered in dark green leather, and the whole atmosphere is conducive to reading and study.

At the head of the stairway, on the second floor, are a couple of small rooms for students. The archives department is given a large room on the east side; and on the west side, over the reading room, is a similar room for the housing of the splendid collection of material on the discovery and history of the Pacific North-West which has been diligently collected by Mr. Scholefield. On the south side, on top of the stackroom, is the map room. In floor cabinets in these rooms will be displayed, under glass, books, documents, letters, diaries, and other papers which can be exposed to the light without danger, and these will be so illuminated as to give a clear view of them.



Main portico of the library.

On the ground floor is the cataloguing room, and in the basement are quarters for the travelling libraries department. The public entrance to the library is on the east side of the block, in the corner where the block joins the legislative wing of the main building. A passenger elevator adjoins the entrance.

The stackroom occupies the south portion of the building from the basement up to the top of the main floor. The shelves are of steel, and are so placed that every inch of space is utilized, while ample room is given for the handling of the books and newspaper files. The whole structure is as nearly fireproof as possible.

The lighting of the building is perfection. There are plenty of windows; the light streams in from three sides with nothing to block it, and future building plans will not interfere with this abundance of natural light.

Marble work in the rotunda.

Variations in the Cost of Track Concreting

By S. Gausmann

THE following costs of concreting in connection with paving between modern street railway tracks are based on doing work with no car interference. These costs will be somewhat increased under car operation, with machines outside the tracks, or decreased with machines of larger capacity.

The freight rates for hauling machines to and from work are in accordance with rates approved by the Public Service Commission of the State of New York, First District, and include the total cost of maintenance of the car equipment, cost of trackage and overhead line rights and office expenses of the freight department. These rates vary according to the length of haul, the figures given being for an average haul. This haulage cost would be considerably reduced where the track department does its own handling of material, etc., and where only the wages of crews are charged against it instead of having the freight department make a general charge per car-mile.

Cost with Batch Mixer

The batch mixer, for which the following costs for operation are given, is of 0.5 cu. yd. capacity. It can be bought, mounted on a car, for $1,300, and is electrically operated as to mixing only, so that it must be hauled to and from the work daily.

The number of men employed and their rates per hour in operating a machine of this character are: one assistant foreman, 25 cents; one operator, 25 cents; four laborers, 20 cents; six laborers, 18 cents; fourteen laborers, 16 cents; one checker of time and material, 15 cents—or a total cost of $47.50 for one day of ten hours. This cost is distributed to the various operations as shown in Table 1.

Table 1.—Cost per Day for Gang on One Batch Machine

Operation of the machine	$ 2.50
Watching mix and dumping	4.25
Handling material to the machine	13.50
Removing and placing the track	22.10
Ramming and tamping under the rail	3.85
Checking	1.50
	$47.70
Add other charges:	
Overtime for cleaning	$0.90
Interest on investment	.58
Freight to and from work	6.25
Lubricants, repairs and incidentals	2.33
	$10.06
Total	$57.76

A gang of this size will average in a ten-hour day approximately 675 ft. of single track with concrete 7 ins. deep. The area, with 6 x 8-in. x 8-ft. ties spaced 2 ft. centre to centre, is equal to 94.22 cu. yds., making the unit cost $0.613 per cubic yard, exclusive of material.

Cost with Continuous Mixer

A good continuous mixer of a standard make can be purchased for $560. Although such mixers are supplied on wheels for use at the side of the track, a good car with old pony wheels and a wooden frame can be made for approximately $30, thus bringing the total cost to less than $590. This cost is for a gasoline-operated machine, but an electrically operated one is preferable. Provided an old motor is obtainable, the first cost will vary but little from gasoline, whereas the cost of operation will be less.

As a machine of this kind is easily derailed, it need not be removed from the street daily, and can be left on the work continuously ready for use at any time, with no outlay for freight charges until it is required at other points.

The number of men employed, and their rate per hour, in operating one of these machines are: one assistant foreman, 25 cents; one operator, 25 cents; two laborers, 20 cents; three laborers, 18 cents; eight laborers, 16 cent; one checker of time and material, 15 cents—or a total cost of $28.70 for a ten-hour day. This cost is distributed to the various operations as shown in Table 2.

Table 2.—Cost per Day for Gang on Continuous Mixer

Operation of machine	$ 2.50
Handling material to machine	10.20
Distributing in track	12.10
Ramming and tamping under rail	2.40
Checking	1.50
	$28.70
Add other charges:	
Overtime for cleaning	$0.50
Interest on investment	.26
Freight to and from work	1.25
Gasoline, oil and repairs	2.25
	$4.26
Total	$32.96

This gang will average 430 ft. of single track per ten-hour day, with concrete 7 ins. deep. This area, with 6 x 8-in. x 8-ft. ties spaced 2 ft. centre to centre, is equivalent to 60.054 cu. yds., making the unit cost $0.5488 per cubic yard, exclusive of material.

Mixing by Hand

Of course, in mixing by hand the number of men employed may vary, but for an illustration we may assume that as many are employed as on the continuous mixer, exclusive of the operator. The cost then would be distributed to the various operations as follows:

Table 3.—Mixing by Hand

Distributing material and mixing	$10.50
Distributing in the track	11.80
Ramming and tamping under the rail	2.40
Checking	1.50
	$26.20

This number of men in a ten-hour day will average 225 ft. of single track with concrete 7 ins. deep, which, with 6 x 8-in. x 8-ft. ties spaced 2 ft. centre to centre, amounts to 32.77 cu. yds., equivalent to a unit cost of 80 cents per cubic yard.

The foregoing figures were obtained from many years' experience in this line and from carefully collected data, and appeared in Engineering Record. While they may not apply to all locations, the costs can be easily adjusted to meet any conditions from the information given.

A good trade magazine fills a highly important niche in journalism. Not only does it carry the news of the trade, but it bears serious relation to the industry itself. In many industries it wields a greater power than any single house in that industry. It operates not only as an effective means by which manufacturers can talk to the trade about their products, but it also acts as a stimulant to higher ideals of business, and keeps down the abuses simply by turning the light on them. There is no question at all about the importance of trade magazines when they are under able

Personal Mention

At Stratford, Ont., Mr. George Heideman, City Building Inspector, was made the recipient of a cabinet of silver from the staff of the City Hall on the occasion of his marriage.

Prof. A. M. Gray, assistant professor of electrical engineering at McGill University, has resigned on his appointment as head of the electrical engineering department of Cornell University.

Mr. A. M. West, City Engineer of North Vancouver, B.C., has been appointed a provisional lieutenant in the Canadian Engineers. The City Council have granted him six weeks leave of absence in order that he may go to Esquimalt to pursue his military studies.

The resignations of Mr. Breckon, Water-works Engineer, Mr. D. B. McLay, Assistant Engineer on Construction, and Mr. R. M. Grancey, Bridge Engineer, have been accepted by the City Council of Vancouver, the resignations to take effect on July 31. It is understood that the city has not enough work to keep the whole of the engineering staff employed at present.

Mr. A. F. Barbour, civil engineer, of Boston, has been looking into the water situation at St. John, N.B. The Council are endeavouring to locate springs from which the town may secure pure water. Mr. Barbour will make a report to the Council suggesting the best course to be pursued.

The death is announced of Mr. William Goodfellow, an architect of New Westminster, B.C. He had been a resident of that district for a number of years, and his son, Captain William Goodfellow, now in England with the 29th Battalion, also practised as an architect in New Westminster for some time.

Quebec has lost a well-known architect in the person of Mr. Rene Lemay, who died at his summer residence at Cap Rouge recently. During his active career Mr. Lemay contributed extensively to Quebec's architecture, and many of the modern edifices which are monuments to the commercial expansion of the ancient capital were planned by him. Among the buildings which he designed are the Merger Building, the Dominion Fish and Fruit Building, Quebec Technical School, Caisse d'Economie, St. Roch's, the Lindsay Building, and the new St. Patrick's Church, besides other splendid buildings throughout the province, including Chicoutimi Cathedral. The late Mr. Lemay represented St. John's Ward in the City Council for six years, and he was a former President of the Dominion Association of Architecture.

Mainly Constructional

East and West From Coast to Coast

The Province of Quebec Association of Architects will hold an examination in Montreal from July 26 to 31, inclusive.

Work will be commenced early this month on the erection of the steel on the new viaduct at St. Catharines, Ont. About twenty carloads of steel and timbers to be used in the construction are on the site.

At West La Have, N.S., A. V. Conrad and J. Milledge have incorporated the La Have Concrete Company, Limited, with a capital stock of $50,000. The company will manufacture concrete materials, cement and lime.

Recent floods in Alberta, during which the Bow River reached a height of 37 feet above low level mark, caused a loss in property estimated at a million dollars. The height reached by the river is only slightly lower than the record established sixteen years ago.

The Riverside Water Supply Company, Limited, has been incorporated at Revelstoke, B.C., with a capital stock of $5,000. The company will carry on a general water-works business, with the right to construct water-works systems and to charge tolls for the supply of water.

With a capital stock of $500,000, Universal Stove and Furnace Company, Limited, has been incorporated at Toronto by G. M. Kelley, J. D. Falconbridge, I. A. Cooper, L. C. Stephens, and G. Burley, all of Toronto. The firm will manufacture all kinds of furnaces, including heating and ventilating plants, crematories, incinerators, and blast furnaces.

The Foundation Company, Limited, Montreal, have commenced the construction of the substructure of a bridge over Shaw Creek, near Darling, Ont., for the C. P. R. The work consists of four piers and two abutments, with the necessary retaining and wing walls. Two of the piers will be built by pneumatic caissons, and the other two by the open dredging method.

In connection with the harbour improvement scheme at Toronto, the space between the piles sunk last year opposite the Lake Shore Road and the shore is being filled in. The distance between the piles and the shore varies between 700 and 1,300 yards. A large suction dredge is at work on the fill, delivering sand, etc., from the bottom of the lake outside the piles, through a pipe line to the fill.

The contract for the second addition to No. 1 elevator of the Montreal Harbour Commissioners has been let to the Geo. A. Fuller Company, Limited, Montreal. The piling contract is now being carried out by the Peter Lyall and Sons Construction Company, Limited, Montreal. The plans were drawn up by the John S. Metcalf Company, Limited, Montreal. This is one of the largest contracts given out this season in the city.

With the exception of strips aggregating about seventy-five miles, ballasting on the British Columbia sections of the Canadian Northern Pacific Railway has been completed. Work is proceeding on the unfinished sections, and arrangements are being made to start the construction of station buildings at an early date. Sir William Mackenzie is reported as saying that the line will be ready for operation by September.

The City Council of Toronto have decided to expropriate Grosvenor Street Presbyterian Church in order to make room for the extension of Terauley Street. Notice of expropriation was served last summer, but it is not known yet when the old buildings will be demolished. There was some doubt as to whether the city wanted the whole of the church property or only a part of it, but it has been finally decided to take over the whole property.

The contract for the erection of the substructure of the Moncton bridge over the Petitcodiac River, N.B., has been let to Engineers and Contractors, Limited, Granville Ferry, N.S. A few weeks ago the Provincial Government let this contract to another firm but later withdrew the work, and invited fresh tenders. As a result of this the contract has been given out as above. Owing to the enormous rise and fall of the tide in the river the work will involve some difficult problems.

The opening is announced of the new Customs House at Calgary, Alta. At present the various divisions of the Customs Department are located under five different roofs, but the new building, which has been under construction for two years, will house the whole of the Department comfortably. The architect for the building was Mr. Dowler. It is constructed of Calgary brick and Calgary stone, and covers an area 100 x 120 ft. It includes examining warehouses and administration offices. The cost of construction was $500,000.

The walls of the new Government dock, Vancouver, are nearing completion. Twenty-one cribs for the foundation have been sunk already, and it is expected that the remainder of the cribs will have been sunk by the middle of this month. The foundations and the 800-ft. wall on the west side of the dock are completed. The contractors for the dock, Messrs. Henry, McFee & McDonald, have just accepted a contract from the Great Northern Railway of half a million dollars for double tracking and snow sheds in the Cascade Mountains.

The difficulty over the supply of asphalt for the city of Montreal has been overcome by the discharge, by Chief Justice Archibald, of the injunction granted to Mr. C. P. Dubuc, representing Mr. J. Baker, Jun., of New York, restraining the city from entering into a contract with the Aztec Oil and Asphalt Refining Company. The removal of the injunction was unopposed. The Aztec Company were willing that the Board of Control should cancel the provisional contract agreed upon, and this opened the way for the Controllers to call for fresh tenders. The injunction was originally granted on the ground that the Controllers had exceeded their authority.

The City Council of New Westminster, B.C., have endorsed an agreement with the Vancouver, Victoria and Eastern Railway under which the railway company will build and operate industrial tracks, serving the leaseholders on the improved water front area. It is provided that the city may at any time take over the tracks on payment to the company of the cost of construction, should the city desire to operate them. Application will be made to the Railway Board for permission to proceed with the work, and as there is no opposition on the part of the other railways such permission will probably be granted by wire, enabling construction to be started immediately.

At the meeting of the representatives of the municipalities interested in the construction of the Toronto-Oshawa road held at the City Hall, Toronto (as noted in our last issue) Mr. W. A. McLean gave the costs of nine different pavements. The cost of a concrete road was placed at $625,000, and a macadam and gravel roadway at $239,000. Some of the representatives stated that their municipalities could not afford to pay for a concrete pavement. Mr. McLean strongly recommended the construction of a macadam and gravel roadway. He said that it would give good service for the probable traffic of the next ten years. A committee was appointed to consider further Mr. McLean's report and to report on the type of road they would recommend to be built, and also to consider the question of the taxation of abutting lands and provision for the maintenance of the road. It is expected that the scheme will be worked out amicably.

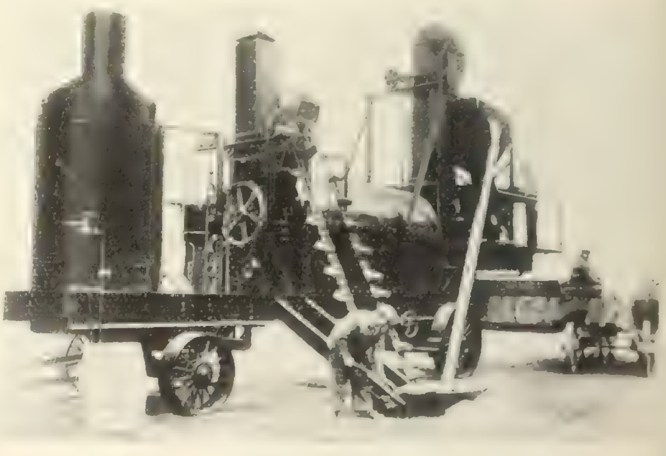
Over a million dollars has been spent by the Ford Motor Company of Canada on buildings in Canada during the last year. These include new branch buildings and assembly plants at Montreal, Toronto, and London, and an addition to their factory at Ford, Ont. The Montreal building, which cost a quarter of a million dollars, opened its doors on January 23rd, when it housed the annual Montreal Motor Show. The Toronto branch building cost over $325,000, and was opened late in February. The London building was ready for use about the middle of March, and cost $140,000. The factory addition at Ford, Ont., involving an expenditure of $300,000, is now practically completed. The building of the present addition added 130,000 square feet of floor space, bringing the total floor area up to more than nine acres. Plans are now under way for buildings of equal magnitude in Winnipeg and other branch cities, and it is stated that work will be started on these in the near future.

According to Mr. W. W. Butler, Vice-President of the Canadian Steel Foundries, Limited, and the Canadian Car and Foundry Company, he has been successful in closing a contract in Petrograd for five million artillery shells. This is said to be one of the largest contracts ever given by Russia for foreign-made ammunition. The shells will be manufactured in Canada, and will be delivered to the order of the Russian Government at Canadian ports. There has been some delay in securing the machinery to make the shells for this order, but it is anticipated that the necessary lathes, etc., will be installed by the middle of July, when day and night crews will be put to work. The company will do both the forging and the machining.

Portable Asphalt Mixing Plant

A new portable asphalt mixing plant having a number of distinctive features has just been put on the market. For a plant of its size and cost it is unusual in having a minimum capacity of 800 square yards of two-inch sheet asphalt topping per day of ten hours. The capacity for asphaltic concrete, Topeka mix, or asphalt macadam is much larger.

The mixing platform of the plant is so elevated that a wagon can be driven under it to receive the load from the mixer without elevating the plant on its wheels or excavating for this purpose. The platform is arranged for one-man operation, the levers for controlling clutches and plant being within easy reach. The mixer is a two-shaft, pugmill type, with removable side and end liners; it is provided with two full sets of blades, the binder being solid manganese. The sand-measuring box and asphalt bucket are supported on scales. A drying drum of special construction has been designed for this plant to obviate the difficulties so often encountered in heating a sufficient amount of sand and stone. Features that count in the economical upkeep of such plants as this are the removable steel wearing plates in the material chutes and chilled rims for all chain sprockets.



Plant in operation.

As illustrated, the plant would be operated as two units, the second unit being the asphalt kettle. The mixing plant is also supplied without boiler and engine. In other words, the contractor or municipality already provided with a portable boiler, engine and kettles can secure the mixing plant without making an additional investment for these units.

The plant is designed especially to meet the requirements of contractors and municipalities having new construction and maintenance work to perform in scattered territory, or in an amount insufficient to make a stationary plant economical. It is the product of the Iroquois Works of the Barber Asphalt Paving Company, Buffalo, N. Y.

A New Type of Drag-Line Bucket

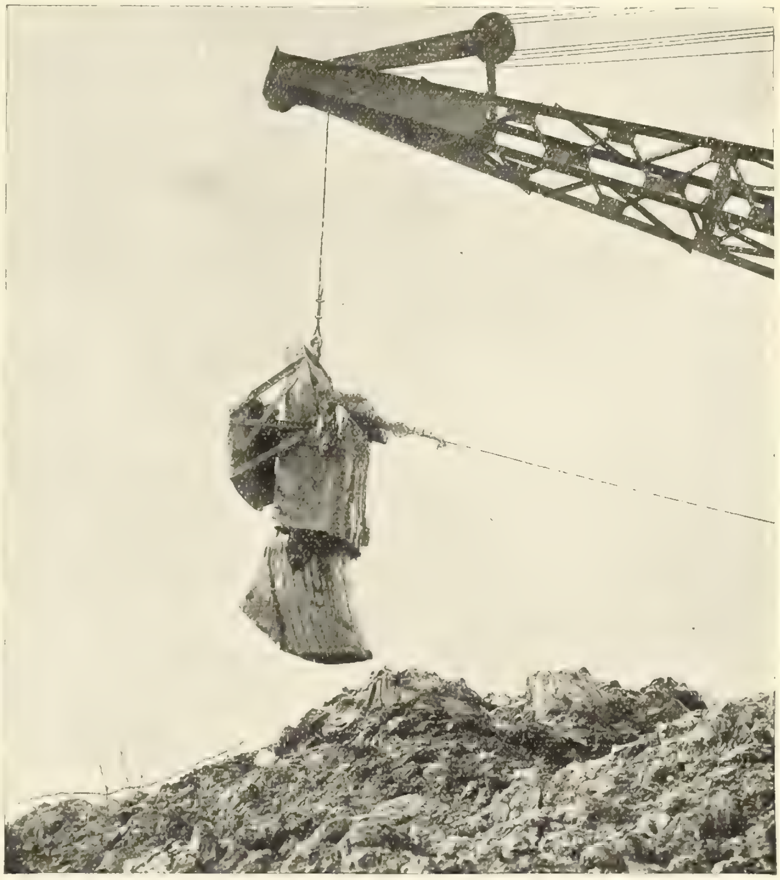
AFTER a five-year try-out on the Calumet-Sag and North Shore channels, which are additions to the large system of the Chicago drainage canals, a new form of drag-line bucket, as illustrated herewith, is being introduced to the trade. It is a back-dumping bucket, and consists of a shell, pulling bail, and a combination hoisting bail and back gate. In its digging position the pulling bail is connected to the shell at points above its centre of gravity. The pulling bail is also connected by means of links to the hoisting bail and back-gate in such a manner that tension on the drag-line closes the gate and keeps it closed. When the bucket is suspended on the hoisting bail and the tension on the drag-line is released the back of the shell tips down away from the back-gate, allowing the load to slide and drop out. Bronze sliding blocks carried in slots in the shell connect it with the pulling bail, and these slots give the required motion to the link connections to permit the bucket to dump when the tension on the drag-line is released. Special attention is given to the flexibility of the bucket, and binding in any of the parts is prevented by the provision of loose-fitting connections. All standard buckets are equipped with teeth bolted to the digging edge at an angle to give the proper "suck." Rock teeth set at the proper angle are furnished with the bucket for heavy digging in rock. The teeth are tipped with manganese steel points, which can be replaced when worn.

The construction of the bucket is simple, and repairs can be made in the field with the average contractor's tool or shop equipment. All bushings are made from bronze and steel tubing.

The bucket is operated with two single-part lines—a drag-line and a hoist-line. By the manipulation of these two lines the bucket is placed in different positions. The bucket may be made to dig at any slope desired by varying the tension on the hoist-line while paying it out. When the bucket is filled it is raised to the dumping position at the end of the boom by pulling in on the hoist-line while keeping the drag-line taut. When the tension on the drag-line is released the bucket is dumped. The shell automatically resumes its closed position after dumping.

As the bucket is back dumping the load is always thrown away from the machine, and the centrifugal force imparted by the swinging of the boom assists the dumping of the load beyond the radius of the machine. Both bails are very short, and permit the bucket to dig right up to the machine.

The bucket was designed by Mr. Shnable, of the contracting firm of Shnable & Quinn, for use on their work on Section 10 of the Calumet-Sag Canal. The patents on this drag-line bucket have been purchased by the Brown Hoisting Machinery Company, of Cleveland, Ohio, who are now manufacturing the bucket as a Brownhoist product.



Dumping drag-line bucket.

Mr. J. E. Carreau, dealer in and manufacturer of church ornaments, decorations and furniture, has taken offices, show rooms, and manufacturing premises at 13 Notre Dame Street East, Montreal. He has had many years' experience in this line of business, and is well known in Catholic ecclesiastical circles. Mr. Carreau supplied the dado, communion rail, and table for St. Charles Parish Church, Centre Street, Montreal; he furnished three altars and baldequin, the Bishop's throne and pulpit, etc., for the chapel of the Clercs of St. Viateur at Joliette, Que.; two altars, communion furniture, complete set of stations of the cross (in artificial marble), for the Church of St. Francis d'Assisis at Longue Pointe, and many other similar contracts. This firm make a specialty of artificial marble, statuary, pictures, and religious ornaments such as are to be found in all Catholic churches. They are the only manufacturers of some of these lines in Canada, and are among the leading dealers in church furnishings.

The Cranford Construction Company, of Cincinnati, Ohio, have secured the contracts for Simplex concrete piling for a passenger station and a bridge foundation to be erected at Johnstown, Pa., for the Pennsylvania Railroad.

A description of a 900-gallon auto flusher for street cleaning work forms the central feature of a catalogue issued recently by the Tiffin Wagon Company, of Tiffin, Ohio, who also make a line of horse-drawn motor power flushers and motor-driven and horse-drawn sprinklers, besides dump wagons and sanitary garbage carts. As described in the catalogue, the flusher is mounted on a motor truck chassis (built by the same company), and an extra four-cylinder gasoline engine on the rear end of the chassis drives a two-stage centrifugal pump with a capacity up to sixty pounds pressure. The tank may be filled from hydrant or standpipe, or from streams or cisterns if desired, in which case a special attachment is provided. The flusher nozzles are provided with universal joints, enabling two streams of water to be directed at any angle.

The Canadian Pacific Railway Construction Corps, under Lieut-Col. C. W. Ramsay, of the C. P. R., have arrived in England. The corps, which trained in St. John, N.B., took with them a large supply of equipment for building railways and bridges.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Amherstburg, Ont.
The Town Council have been petitioned to lay a pavement on Sandwich and Aspley Streets. Approximate length, one mile. Clerk, G. E. Pulford.

Bathurst, N.B.
The City Clerk, John G. Staut, will receive tenders until 8 p.m., July 10th, for the construction of a dam, power house, boiler house, piping, pumping station, mains, sewer pipe, manholes, and a standpipe, with a capacity of 405,000 gallons. Plans and specifications with the Clerk.

Beamsville, Ont.
The Town Council have had plans drawn for concrete sidewalks to be laid on a number of streets by day labor. Clerk, W. D. Fairbrother.

The Town Council contemplate laying about ¾ mile of pavement. Clerk, W. D. Fairbrother.

Didsbury, Alta.
The Town Council are considering the construction of a quantity of cement sidewalks. Clerk, A. Brusso.

Fort Erie, Ont.
A by-law has been carried providing for the construction of a concrete road from the North Line to Buffalo Ferry, and of a number of village streets. Town Clerk, W. Simmonds.

Grimsby, Ont.
Plans are being prepared for paving to be laid on all streets excepting Main Street, which will be paved by the County. Town Clerk, C. H. Bromley.

Guelph, Ont.
The City Engineer is preparing plans for the construction of concrete sidewalks on Harris Street, and of a 30-inch concrete pipe on Dundas Road. Clerk, T. J. Moore.

Harwich Township, Ont.
The Township Council have decided to lay a number of tile drains. Work to commence very shortly. Clerk, G. W. Riseborough, Blenheim, Ont.

Moulton Township, Ont.
The Township Council will receive tenders until noon, July 14th, for the construction of a drain. Work to include about 27,000 cubic yards of excavation. Plans and specifications with the Township Clerk, G. A. Duff, R. R. No. 1, Low Banks, Ont., and with A. M. Jackson, Engineer, Temple Building, Brantford.

Ottawa, Ont.
Tenders on trenching, cartage, and laying of water pipe will be received until August 3rd by the Chairman of the Waterworks Commission. Plans and specifications at offices of the Waterworks Engineer, R. L. Haycock, and of the Consulting Engineer, S. B. MacRae, Sparks Street.

The Chairman of the Waterworks Commission will also receive tenders until August 3rd on the supply of high lift pumps and motors for Lemieux Island. Plans and specifications with the above Engineers.

Pelham Township, Ont.
Tenders on drainage work will be received until July 16th by the Township Clerk, A. N. Armbrust, Ridgeville. Plans and specifications with the Clerk.

Sackville, N.B.
The Town Council are considering two suggestions for an addition to the waterworks, viz.:—the erection of a large tank or the purchase of an automatic pump at a cost of about $3,000. Clerk, Thomas Murray.

Sudbury, Ont.
The Town Council contemplate laying a quantity of pavement. Clerk, W. J. Ross.

Thurlow Township, Ont.
Tenders on the construction of concrete walks will be received until July 20th by the Trustees of School District No. 1. Secretary, W. C. McDonald, R. F. D. 109, Belleville.

Toronto, Ont.
W. A. McLean, Provincial Highways Engineer, Parliament Buildings, has reported that the cost of the Toronto-Oshawa highway will be about $625,000 for concrete construction, and $239,000 for macadam and gravel. He has recommended the latter method.

CONTRACTS AWARDED

Calgary, Alta.
The contract for paving at Hudson's Bay Reserve has been let by the City Council and the Hudson's Bay Company to the Crown Paving Company, Rideau Park, at $125,000.

Eastview, Ont.
The contract for laying concrete and sandstone block sidewalks on Montreal Road has been let by the Town Council to D. Desjardins, Eastview. Approximate cost, $9,000.

Grey Township, Ont.
The Township Council have awarded the contract for the construction of the Beauchamp drain to August Guhr, Seaforth, Ont. Approximate cost, $23,000. Work has been commenced.

Saanich, B.C.
A contract for grading on North Quadra Street has been let by the Town Council to Jones & Rant, Limited, Saanich, at $8,688.

St. Vital, Man.
Contracts for laying concrete pavement have been let by the Municipality to Guilbault Company, Limited, St. Boniface, for St. Anne's Road, and part of St. Mary's Road, and to T. Jackson & Sons, 370 Colony Street, Winnipeg, for the remainder of St. Mary's Road.

Sydney, N.S.
The City Council have let the contract for the erection of the pump house at Middle Lake to Chappell Bros. Company, Limited, 62-80 Brooklands Street, at $13,000, and for the supply of pumps to the Turbine Equipment Company, Limited, C. P. R. Building, Toronto.

Whitby, Ont.
The Town Council have let a contract for the construction of approximately 50,000 square feet of cement sidewalks and crossings to J. T. Hornsby, Athol Street, at 9.4c. per foot.

Wingham, Ont.
The Town Council have let a contract for the construction of sewers on St. Patrick Street to T. J. McLean & Company, Wingham, and on John and Minnie Streets to Greenaway & Guest, Wingham.

Railroads, Bridges and Wharves

Arden, Man.
The Municipality of Lansdowne are considering the erection of a reinforced concrete bridge over White Mud River. One span, 90 feet long, roadway 18 feet wide. Secretary, M. E. Broughton, Arden.

Broadview, Sask.
The Canadian Pacific Railway are receiving tenders on waterproofing work in connection with the construction of a concrete subway. Plans and specifications with the Divisional Engineer. J. S Holden, Winnipeg.

Dover Township, Ont.
Tenders on the construction of two steel and concrete bridges will be received until July 10th by P. Antaya. Paincourt. Plans and specifications with the Township Clerk, J. Welsh, Chatham, and the Engineer, W. G. McGeorge, 153 Queen Street, Chatham.

Grey County, Ont.
Tenders on the construction of three concrete arch bridges will be received until 6 p.m., July 10th, by the County Clerk, F. H. Rutherford, Owen Sound. Plans and specifications with the Warden, County of Bruce, Burgoyne, with J. W. Sinclair, Tara, with the Clerk, and at office of R. McDowall, Engineer, 635 Second Avenue W., Owen Sound.

Melanchton Township, Ont.
The Township Engineer, I. Traynor, Dundalk, is preparing plans for four reinforced concrete bridges for the Township Council.

Renfrew County, Ont.
The Township Engineer, J. L. Morris, Pembroke, has prepared plans for a bridge between Stafford Township and

Pembroke. Clerk, R. J. Rooney, Pembroke.

CONTRACTS AWARDED

Brant County, Ont.
Work is to start at once on the erection of two steel and concrete bridges for the County Council. The contract for steel has been let to Hamilton Bridge Works Company, Limited, Hamilton, at $1,834, and for concrete work to G. Thompson, 223 West Mill Street, Brantford, at $2,900.

Edmonton, Alta.
The Edmonton, Dunvegan & B. C. Railway have let the contract for the construction of about 60 miles of railroad between Spirit Lake and Grande Prairie to G. H. Webster, 1316 Prospect Avenue, Calgary.

Farnham, Que.
The Municipality have let the contract for the concrete work and construction of approaches for several bridges to Andre Choiniere, Farnham.

La Baie St. Paul, Que.
The general contract for an addition to the dam for L'Hospice de la Baie St. Paul has been awarded to Baie St. Paul Electric Company, at $3,500.

Lanark County, Ont.
The County Council have awarded a contract for the erection of a bridge over the Clyde River to the Ontario Bridge Company, Crown Building, Toronto, at $8,950. Steel girder construction, cement piers, abutments, and floor.

Lindsay, Ont.
The contract for the construction of a bridge over the Scugog River for the Department of Public Works, Ottawa, has been let to Hamilton Bridge Works Company, Limited, Bay Street N., Hamilton.

Simcoe County, Ont.
The County Engineer, F. Barber, 57 Adelaide Street E., Toronto, is in the market for supplies for the construction of bridge abutments.

Public Buildings, Churches and Schools

Bryant, Sask.
Tenders on the erection of a school for the Trustees of School District No. 3505 will be received until July 9th by the Secretary, André Walton. Plans and specifications from the Secretary, Mercury Office, Estevan, and from Waterman & Waterbury, 115-118 Donahue Building, Regina.

Charlottetown, P.E.I.
Tenders on repairs to Grace Methodist Church and parsonage will be received until July 15th by R. E. Mutch, c/o R. E. Mutch & Company, 77 Grafton Street. Specifications with Mr. Mutch.

Dartmouth, N.S.
Tenders will be received until 4 p.m., July 12th, by R. C. Desrochers, Department of Public Works, Ottawa, for interior fittings for the Post Office. Plans and specifications with E. H. Whalpley, Clerk of Works, Dartmouth, W. Bishop, Inspector, Dominion Buildings, Halifax, and at the Department, Ottawa.

Fairbank, Ont.
Tenders will be received until July 10th by W. Deacoff, Dufferin Street, for repairs and painting at North School, and for concrete work at Vaughan Road School. Plans and specifications with the Architects, Edwards & Saunders, 18 Toronto Street, Toronto, and with Mr. Deacoff.

Hawkshaw, N.B.
A church is being built by day labor for the Baptist Congregation. Estimated cost, $3,000. Seating will be required. Chairman of the Building Committee, G. F. Burden, Poquiock, N.B.

Kingsville, Ont.
W. Valentine, Secretary to the Board of Education, will receive tenders for the installation of closets and septic tanks. Plans and specifications to be furnished by tenderers.

Lake Johnson, Sask.
The Trustees of School District No. 2465 have been empowered to borrow $3,500 for the erection and equipment of a school. Treasurer, A. Rutledge.

Peterborough, Ont.
Plans are being prepared for repairs to the County Court House. Clerk, E. M. Elliott.

Port Colborne, Ont.
Plans and specifications for a Public School, estimated to cost $35,000, have been submitted to the Board of Education by the Architect, C. M. Borter, 102 Main Street, Niagara Falls South.

Sayabec, Que.
The School Commissioners are building a school by day labor, at an estimated cost of $20,000. Secretary, T. Levesque.

Toronto, Ont.
The Board of Education will receive tenders until July 13th for the enlargement of Mc Murrich School and for midsummer repairs at various schools. Plans, etc., at office of the Building Superintendent, City Hall.

Wadena, Sask.
The Trustees of School District No. 1435 have been authorized to borrow $3,000 for construction of foundations and repairs to school, and for various other improvements. Treasurer, L. C. Wirtz, Dana.

Wickam West, Que.
The erection of a school, estimated to cost $5,000, is being considered by the School Commissioners. Secretary, A. J. Vanasee.

CONTRACTS AWARDED

Hamilton, Ont.
The contract for wiring at the Barton Street Hospital has been let by the City Council to Culley & Breay, 35 King Street W.

Newcastle, N.B.
The contract for the installation of an elevator in the Miramichi Hospital has been let to the Otis-Fensom Elevator Company, 146 Hollis Street, Halifax.

Newport, Que.
J. H. Martin & Fils, Trois Pistoles, are erecting a church for the Roman Catholic Congregation, estimated to cost about $78,000. Stone and brick construction, zinc roofing.

Regina, Sask.
Work has been started on the erection of a hospital and nurses' home by the general contractors, L. Poole & Emery, Smith Street and Twelfth Avenue. The contract for millwork has been let to Gushing Bros., Dewdney Street, and for heating and plumbing to the Capital Plumbing & Heating Company, 1306 Eleventh Avenue. Approximate cost, $20,000.

St. Louis de Courville, Que.
In connection with the church in course of erection, the contract for heating, plumbing, and electrical work has been let to Jobin & Paquet, Abraham Hill, Quebec, and for painting to the general contractors, Elz, Metivier & Son, St. Damien.

Toronto, Ont.
The Johnson Heat Regulator Company, 118 Adelaide Street W., have been awarded contracts for heat regulators at Rosedale and Jesse Ketchum Schools.

The Board of Education have awarded the following contracts for plumbing:—Brown Street School, Balmy Beach, A. E. Melhuish, 1174 College Street, $1,519; Pape Avenue, Purdy Mansell Company, 61 Albert Street, $796; Earl Grey, J. R. Seager, 799 College Street, $1,065; Humberside, Earlscourt, R. Paterson, 907 Keele Street, $1,697.

Business Buildings and Industrial Plants

Camrose, Alta.
Tenders on the erection of a telephone exchange building will be received until noon July 9th, by The Deputy Minister of Public Works, Edmonton. Plans and specifications at offices of the Provincial Architect, Edmonton, and of the Depart of Public Works, Calgary.

Gananoque, Ont.
The Steel Company of Canada are considering the erection of an addition to their factory on Mill Street. Stone construction, composition paper roofing. Approximate cost, $3,000. Manager, F. B. Cowan.

Glencoe, Ont.
John McVicar, Ferguson's Crossing, Glencoe P.O., is building farm buildings estimated to cost $3,500. Frame construction.

Katesville, Ont
Farm buildings are being erected by J. Godard, Ailsa Craig P. O. Approximate cost $3,000.

Montreal, Ont.
A. Racine, Limited, 1967 St. Urbain Street, have commenced the erection of a carriage factory, estimated to cost about $3,000. Brick construction.

Moose Jaw, Sask.
Tenders on alterations to business premises for E. Matthews, Maple Leaf Hotel, are being received by Reilly, Dawson & Hancock, Room 20, Russell Block. Brick and frame construction. Estimated cost, $6,000.

Oshawa, Ont.
The erection of a shell factory on Emma Street is contemplated, and a bylaw providing for the loan of $8,000 for this purpose will be voted on shortly. E. L. Crabtree, c/o the Dominion Machinery Company, 82 Adelaide Street E., Toronto, is an interested party.

Paris, Ont.
Plans of stock sheds have been prepared for W. G. Bailey by L. A. Wardell, 110 Hunter Street W., Hamilton. Frame construction, concrete foundation.

Red Deer, Alta.
Tenders on the construction of a warehouse on Gaetz Avenue N. for Nash Bros., Minneapolis, Minn., will be received until July 12th by Seymour & Dawe, Architects, 5 Gaetz Avenue N. Brick construction, concrete flooring, patent roofing.

St. John, N.B.
Work has been started by day labor on the construction of a warehouse for C. H. Peters & Sons, Limited, Ward Street. Approximate cost, $10,000.

Sydney, N.S.
The building now in course of erection for the B. Atkinson Estate will be finished as stores and apartments, the arrangements with regard to a theatre having been abandoned.

Tavistock, Ont.
Krug Bros. are building a store on Woodstock Street. Brick construction.

Toronto, Ont.
W. Watson, No. 2, The Maples, Bain Avenue, has commenced work on alterations and additions to stores and residences at 612 Logan Avenue. Brick construction, felt and gravel roofing. Approximate cost, $3,000.

Work has been resumed on the erection of stores and apartments at 1830 Queen Street E., by Grimshaw Bros., 34 Brookmount Road. Brick construction, tar and gravel roofing. Approximate cost, $15,000.

Welland, Ont.
The erection of two stores and a flat on Main Street is contemplated by H. Kaplin. Estimated cost, $10,000.

Windsor, Ont.
J. C. Pennington, Labelle Building, is preparing plans for alterations to business premises on Dougal Street for J. F. Smythe, 150 Ouellette Avenue. Estimated cost, $3,500.

Yarmouth, N.S.
Tenders on the erection of a station for the Halifax & South Western Railway will be received until noon, July 17th, by the General Superintendent, J. Bain, Bridgewater, N.S. Plans and specifications with the General Freight & Passenger Agent, Halifax, with the Agent, Yarmouth, and with the General Superintendent.

CONTRACTS AWARDED

Auburn, Ont.
David Lochart has let the general contract for remodelling farm buildings to James McGill. Approximate cost, $3,000.

Hagersville, Ont.
A branch is being erected at Howard and King Streets for the Union Bank of Canada, Winnipeg, Man. The contract for carpentry has been let to R. A. Nicholson, 4 Hamilton Avenue, Mount Hamilton, the roofing contract to H. W. Johns-Manville Company, 19 Front Street E., Toronto, the painting contract to E. Foley, 35 Oak Avenue, Hamilton, the contract for plumbing to Staunton & Mitchell, 173 York Street, Hamilton, and for electrical work to Culley & Breay, 35 King Street W., Hamilton.

Montreal, Que.
The contract for the erection of a garage at Ann and Ottawa Streets for the Montreal Light, Heat & Power Company has been let to T. L. McBean, 29a Belmont Street. Steel construction.

Moose Jaw, Sask.
The F. W. Woolworth Company have let the contract for alterations to their store to Poole & Emery, 20 Russell Block. Approximate cost, $10,000. Canadian Manager, R. Connable, Queen and Yonge Streets, Toronto.

Ottawa, Ont.
The contract for the erection of a garage on Frank Street for J. B. and W. H. Fraser, 50 Robert Street, has been let to S. F. Smith, 448 McLeod Street. Brick construction, stone foundation, felt and gravel roofing. Estimated cost, $5,000.

St. John, N.B.
In connection with the stores being built for Scovil Bros., Limited, King Street, the contract for tile work has been awarded to Nonneman Tiling Company, 254 Union Street.

Work has been commenced on remodelling the Bank of British North America at Union and Sydney Streets by Edward Bates & Son, 73 Duke Street. Approximate cost, $9,000.

In connection with the stores to be erected at 55-57 King Street for Scovil Bros., Limited, the contract for prism glass has been let to Luxfer Prism Company, Limited, 100 King Street W., Toronto, and the plastering contract to the general contractors, B. Mooney & Sons, 112 Queen Street. Contract for electrical work and fittings not let.

Toronto, Ont.
Alterations are being made to offices at Yonge and Victoria Streets for the Confederation Life Association, Yonge and Richmond Stretes. The contract for masonry has been let to Brown & Love, 46 Price Street. Approximate cost, $10,000.

Windsor, Ont.
The general contract for alterations to a billiard parlor for W. McGregor has been let to R. Westcott, 55 Oak Street. Approximate cost, $5,000. Architect, J. C. Pennington, Labelle Building.

Residences

Alderville, Ont.
Tenders on the erection of a teacher's residence on the Indian Reserve will be received until noon, July 22nd, by Duncan C. Scott, Department of Indian Affairs, Ottawa. Plans and specifications at the Post Offices, Cobourg and Alderville, at the office of W. R. Coyle, Indian Agent, Roseneath, and at the Department.

Beamsville, Ont.
Robert Culp is building a frame and reinforced concrete residence. Estimated cost, $3,500.

Crowland Township, Ont.
Fred Hogue, Myrtle Avenue, Welland, is considering the rebuilding of his residence.

The erection of a residence and barn to replace those destroyed by fire is b ing considered by Charles E. Furr, R. R. No. 1, Welland.

Curt Hill, Sask.
Tenders on the erection of a parsonage for the German Lutheran Congregation will be received until July 9th. Plans and specifications with E. J. Luedtke, Willmar Street. Frame construction.

Forest, Ont.
A residence is being built by J. Perre, Ann Street, at an estimated cost of $3,200. Frame and white brick construction.

Grimsby Twonship, Ont.
A residence is being built at Grimsby and Queenston Roads for John Rudolph, Grimsby Beach. Pressed brick construction, concrete foundation, shingle roofing. Estimated cost, $4,000.

R. C. Van Dyke is erecting a residence, estimated to cost $3,500.

Hull, Que.
A permit for the erection of a residence has been issued to Edward Pelletier, Montcalm Street. Brick construction, stone foundation. Approximate cost, $6,000.

Lac Aux Saumons, Que.
Plans of a residence to be erected for the parish have been prepared by Ouellet & Levesque, 115 St. John Street, Quebec. Frame and brick construction, concrete foundation, metal roofing. Approximate cost, $4,000.

Lakeside, Que.
A contract is open for the removal of a house belonging to the Marcil Trust Company, 180 St. James Street, Montreal. Particulars from J. O. Harris, Architect, 180 St. James Street, Montreal.

Ottawa, Ont.
The erection of a residence on Bellwood Street is being considered by the Oakland Land Company, c/o C. C. Ray, 58 Sparks Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,500.

B. A. Grison, 89 Fentiman Avenue, is receiving prices on plastering, painting, heating, plumbing, and electrical work required in the erection of two residences.

C. Goannis, 359 Le Breton Street, is considering the erection of a residence at an estimated cost of $4,000. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $4,000.

Poplar Point, Man.
Tenders on the erection of a parsonage will be received at St. Anne's Parsonage until July 10th. Plans and specifications with the Pastor, Rev. J. H. Hill.

Quebec, Que.
The masonry and carpentry work in connection with the residence being built on Aberdeen Street by E. C. Brochu, 147 St. Cyrille Street, will be done by day labor.

Rauol Gosselin, 171 First Street, is erecting a residence, estimated to cost $6,000. Brick and frame construction, concrete foundation, metal and asbestos roofing.

Alphonse Plante, 15 Kirouac Street, has commenced the erection of a residence on Victoria Street, estimated to cost, $3,000. Frame and brick construction, concrete foundation, metal and asbestos roofing.

Toronto, Ont.

R. C. Vaughan, 22 Summerhill Gardens, is erecting a residence, estimated to cost $4,500. Brick construction.

Tenders on the purchase and removal of three residences are being received by W. H. Hinton, 1 Harshaw Avenue, Secretary to School Section No. 32, York.

Verdun, Que.

Work on the erection of a residence has been started by E. Lamarre, 56 Gertrude Street. Brick construction. Approximate cost, $3,000.

Westmount, Que.

Work has been commenced on the erection of an addition to the residence of F. C. Wilson, 46 Belvedere Street, by day labor. Estimated cost, $12,000.

Windsor, Ont.

J. C. Pennington, Architect, Labelle Building, is preparing plans for a flat to be erected at Pine and Pelissier Streets. Estimated cost, $6,500. Owner's name withheld.

Wolfville, N.S.

F. W. Woodworth is about to start work on the erection of a frame residence, estimated to cost $3,000.

CONTRACTS AWARDED

Beauport, Que.

Work has been commenced on the erection of a residence for Alfred Marcil. The general, masonry, and carpentry contracts have been let to V. Talbot, 92 Morin Street, Quebec. Estimated cost, $5,000.

Bridgeburg, Ont.

B. J. McCormick has let the general contract for the erection of a residence to Charles Davis. General contractor will also do roofing and carpentry. Approximate cost, $3,300.

The contract for the erection of a residence for C. E. Hansel, 204 Ontario Street, St. Catharines, has been let to A. Teal, Bridgeburg. Brick veneer construction. Approximate cost, $3,000.

Charlottetown, P.E.I.

The heating contract in connection with alterations to the Manse of St. James' Church has been awarded to James McEachern, 34 Upper Queen Street, and the plumbing contract to Bruce Stewart & Company, 18-20 Queen Street.

Grimsby Township, Ont.

The plastering contract in connection with the residence being erected for T. B. Jarvis has been let to Read & Brider, Beamsville.

Hamilton, Ont.

Mrs. E. Foster, 391 Dundurn Street, has let the following contracts for the erection of a residence at 398 Dundurn Street:—masonry, G. E. Gaylard, 54 Lamorieux Street; carpentry and roofing, J. T. Tullock, 24 Sunset Avenue; plastering, C. J. Hartnup, 69 Aikman Avenue; heating and plumbing, Goodram Bros., 248 King Street W. Painting and electrical work not let.

J. H. Somerville, 28 Prospect Street, is about to build a residence on Leurster Avenue and has let the masonry to R. E. Jones, Maple Avenue, the plastering contract to F. Mountain, 2 Kenilworth Avenue, the contract for heating and plumbing to B. Barnes, and for electrical work to F. Thornton, 174 Balmoral Avenue. Painting not let. Estimated cost, $3,500.

Hensall, Ont.

The general contract for alterations to the residence of Dr. Bean has been let to Thomas Walsh, and the carpentry contract to Roland Cudmore.

Hull, Que.

The general contract for the construction of a brick and stone residence for C. Lebrun, Cloutier Hotel, Albert Street, has been awarded to Frank Albert, Chelsea Road, Wrightville. Estimated cost, $3,000.

Kentville, N.S.

The contract for the construction of a frame residence for John Cross has been let to C. Wright, Wolfville. Estimated cost, $3,500.

London, Ont.

Work has been started on the erection of a residence for Mrs. T. Dennis, 577 Princess Avenue, by Hyatt Bros., 288 Egerton Street. Brick construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

F. Corby, 44 Jacqueline Street, is about to erect a residence for T. Brazier, 358 South Street, at an estimated cost of $3,000. Frame and white brick construction.

Work has been started on the erection of a residence for A. J. Haines, West Avenue, by James Chivas, 80 Tecumseh Avenue. White brick veneer construction. Approximate cost, $3,000.

Montreal, Que.

The general contract for the erection of a residence for Mrs. J. McCormick, 665 LaSalle Road, Verdun Ward, has been awarded to J. Flynn, 473 St. Urbain Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

Ottawa, Ont.

The heating contact in connection with the residenre being erected on Spadina Avenue by J. Villeneuve, 164 Bayswater Avenue, has been let to J. H. Cameron, 2488 Lewis Street, the plumbing contract to F. Tapp, 36 Armstrong Street, and the electrical work to C. C. Gould, 219 Florence Street.

Peterborough, Ont.

The contract for the erection of four residences for Joseph Gray, 500 Gilchrist Street, has been let to Olive & Lane. Brick construction. Estimated cost, $1,800 each.

Quebec, Que.

Work has been started on the erection of a residence for J. Levy, 120 St. Louis Road, by L. H. Peters, Limited, 10 St. Angele Street. Approximate cost, $4,000.

The contract for masonry and plastering for the residence being erected on Aberdeen Street for J. E. Roillard, 38 St. Marie Street, has been let to P. R. Tardif, 260 Napoleon Street. Owner will do roofing, heating, plumbing, and electrical work.

In connection with the erection of a residence at D'Artigny & Ste. Julie Streets for N. Moisan, 23 D'Artigny Street, the masonry and plastering contract has been let to P. Tardif, 260 Napoleon Street. Roofing contract not yet awarded.

The carpentry contract in connection with the residence being built for P. Paradis, 236 D'Aguilon Street, has been let to C. Jobin, 168 Latournelle Street, and the roofing, heating, plumbing, plastering, and wiring contracts to the general contractor, E. Cote, 358-360 Richelieu Street. Painting will be let by the carpentry contractor.

Leon Nadeau, 105 Franklin Street, has let the contract for masonry in connection with the residence being built on Aberdeen Street to J. B. Verrett & Fils, 190 Third Avenue, Limoilou. Roofing not let.

P. Paradis, 236 D'Aguillon Street, has been awarded the roofing contract in connection with the residence being erected on Cartier Avenue by N. Cauchon, 59 Dorchester Street, and the plastering contract has been let to H. Marcoux, 29 Colbert Street.

A residence is being built for Louis Frenette, 78 Cremazie Street, by Frenette & Ratte, c/o owner. Brick construction, concrete foundation, metal roofing. Approximate cost, $4,000.

In connection with the residence being erected on Maisonneuve Avenue by E. Careau, the contract for masonry and plastering has been let to J. B. Verret & Fils, 190 Third Avenue, Limoilou. Carpentry will be done by owner. Roofing not let.

Toronto, Ont.

The general contract for the erection of a pair of residences for Mrs. C. R. Taylor has been awarded to William Taylor, 77 Fuller Street. Brick construction, shingle roofing. Approximate cost, $3,500.

E. Churchill, 3 Orchard Park Boulevard, is building a residence for N. E. Shier, 900 Queen Street E., estimated to cost $3,500. Brick construction, shingle, felt and gravel roofing.

F. J. Rowlin, c/o Office Specialty Company, 97 Wellington Street W., has completed the foundations for a pair of residences on Keewatin Avenue, and has let the masonry contract to Ellis & Son, 320 Mount Pleasant Road. Brick construction, shingle, felt and gravel roofing. Approximate cost, $3,000.

The masonry contract for additions to the residence of C. W. Beatty, 121 St. George Street, has been let to W. Hughes, 216 Simcoe Street. Steel and brick construction. Approximate cost, $7,000.

Westboro, Ont.

J. Stitton, Fairview Avenue, is erecting a residence estimated to cost $3,000, and has let the contract for electrical work to S. Lewis.

Westmount, Que.

Work has been started on the erection of flats on Bruce Avenue for J. A. Besner, 238 Elm Avenue, by S. Berlind, 462 Elm Avenue. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $20,000.

The stone and brick work in connection with the residence being built on Western Avenue for Anselme Letang, 4289 Western Avenue, will be done by the general contractor, J. Quinlan, 4412 St. Catherine Street. The carpentry contract has been let to J. Binette, 259 Wolfe Street, Montreal, and the roofing, heating, and plumbing contract to E. Robert, 93 Vitre Street W., Montreal.

Windsor, Ont.
Plans of a double residence have been drawn for L. C. Brooks, 214 Goyeau Street, and the general contract let to W. H. Creber, Erie and Lillian Streets. Frame construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

Woodroffe, Ont.
L. Henderson, Roxborough Avenue, is building a residence, estimated to cost $3,500. The contract for electrical work has been let to T. E. Hopson, 217 Slater Street, Ottawa.

Power Plants, Electricity and Telephones

Elizabethtown Township, Ont.
A by-law has been passed by the City Council of Brockville, providing for the construction of a power line into the Township. Clerk, G. K. Dewey, Brockville.

Heward, Sask.
Tenders will be received until July 15th by J. E. Johnson, Secretary to the Heward Rural Telephone Company, for labor only required in the construction of the Company's system. Plans and specifications according to Government standard.

Howard Township, Ont.
Plans for the installation of a hydro-electric system have been submitted to the Township Council by W. W. Pope, c/o Hydro-Electric Commission, Continental Life Building, Toronto. Township Clerk, G. McDonald, Ridgetown.

Niagara Falls, Ont.
The City Council are having plans prepared for lighting Falls View. Clerk, W. J. Seymour.

Ottawa, Ont.
Tenders will be received until 4 p.m., July 13th, by R. C. Desrochers, Department of Public Works, Ottawa, for the supply of the following tungsten lamps:—18,000-40 watt; 1,000-60 watt; 1,000-100 watt; 1,000-150 watt; 12-250 watt; 12-500 watt; 8-750 watt. Specifications with T. A. Hastings, Postal Station F., Toronto, R. L. Deschamps, Overseer, Dominion Buildings, Montreal, and the Chief Architect, Ottawa.

Tenders on the supply of transformers, switches, and equipment will be received until August 3rd by the Chairman of the Waterworks Commission. Plans and specifications with the Engineer, R. L. Haycock, and with the Consulting Engineer, S. B. MacRae, Sparks Street.

Rama Township, Ont.
Plans for the installation of an electric power system are being prepared for the Orillia Water, Power & Light Commission, Orillia.

Smithville, Ont.
The Township Council of South Grimsby have had plans drawn for an electric lighting system. Clerk, F. W. Roberts.

Winnipeg, Ont.
The Board of Control will receive tenders on the supply of electrodes, glassware, etc., until 10 a.m., July 16th. Specifications with the Engineer, J. J. Glassco, King and James Streets.

CONTRACTS AWARDED

La Baie St. Paul, Que.
The contract for a penstock for L'Hospice de la Baie St. Paul has been let to Sherbrooke Iron Works, at $5,000.

Montreal, Que.
A contract for the supply of cable, alarm boxes, etc., has been let by the City Council to Northern Electric Company, Limited, 814 Notre Dame Street W., at $47,955.

Fires

Chicoutimi, Que.
Fire has destroyed a store and residence belonging to Gaudreau & Gagnon. Loss, $30,000, partially covered by insurance. Owners will rebuild.

Hamilton, Ont.
Fire has destroyed the planing mill of Thomas Roussel & Son, Nightingale Street. Loss, $9,000, principally on machinery.

Martintown, Ont.
A. E. Clingen's sawmill has been destroyed by fire. Loss, $7,000, partially covered by insurance.

Richard's, N.B.
A sawmill belonging to H. Boulay, M.P. for Rimouski, has been destroyed by fire.

Ridgetown, Ont.
The farm buildings of J. J. Gosnell, have been destroyed by fire. Loss, $3,500, partially insured.

Stevensville, Ont.
A barn belonging to Jacob Snider has been destroyed by fire. Loss, $4,000.

Miscellaneous

Corbyville, Ont.
The H. Corby Distillery Company, Limited, are in the market for one air compressor, either belt or motor driven, capacity from 100 to 200 cubic feet of air per minute, one brass lined or brass end motor-driven pump, capacity from 40 to 125 gallons per minute.

Hickson, Ont.
The Township Council of East Zorra contemplate the purchase of a quantity of road oil. Clerk, James Anderson, Woodstock.

Kingston, Ont.
A by-law has been passed providing for the construction of an incinerator, at an estimated cost of $7,000. Engineer, R. J. McClelland.

Levis, Que.
The Municipal Engineer, Camille Lessard, has reported that immediate repairs are necessary to the retaining wall at Davidson Hill. Specifications will be prepared. Estimated cost, $4,000.

The Municipal Council have decided to purchase 1,000 feet of fire hose. Clerk, Lionel Lemieux.

London, Ont.
The purchase of a motor street cleaner is being considered by the Board of Control. Clerk, Samuel Baker.

Montreal, Que.
Tenders on the supply of 5,000 tons of asphalt will be received until July 13th by the City Council. Secretary, L. N. Senecal.

Pembroke, Ont.
The Town Council are considering the purchase of a combination hose wagon and chemical engine. Clerk, A. J. Fortier.

Peterborough, Ont.
Fire has destroyed the brick plant of Curtis Bros., Smith Street. Machinery is almost totally destroyed.

Stellarton, N.S.
McNeil Bros., New Glasgow, are in the market for machinery for the manufacture of shells. Estimated expenditure, $75,000.

St. Tite, Que.
The purchase of fire apparatus is being considered by the Municipality. Mayor, J. S. Decarufel. Estimated expenditure, $3,000.

Toronto, Ont.
The Board of Control will receive tenders until July 6th for the supply of one air compressor and motor for the Danforth Avenue car barns. Plans at office of the Works Department, City Hall.

Wingham, Ont.
A. McDougall, Turnberry Township, Wingham P. O., is in the market for supplies required in the erection of a number of cement and steel silos.

CONTRACTS AWARDED

Quebec, Que.
The general contract for grading the site of the battlefield on the Plains of Abraham has been let by the National Battlefields Commission to A. Ott & Company, 611 New Birks Building, Montreal.

Winnipeg, Man.
The Board of Control have awarded the contract for the supply of a steam boiler to Babcock & Wilcox, College Street, St. Henry, Montreal, at $2,500.

The Ottawa water-supply project is going to be undertaken. The Board of Water Commissioners have decided to call immediately for tenders for the construction, to cost not more than $475,000. The plan proposes to use water from the Ottawa River unfiltered and to build a pumping station, with two units, at Lemieux Island. The water will be carried across the river to the city in a pipe line either on a bridge on in conduit. J. B. McRae, one of the formulaters of the plan, has been retained by the city to supervise the design and construction.

Meetings of engineers are to be held in San Francisco from Tuesday, September 14, to Saturday, September 25. The Road Congress, under the joint auspices of the American Highways Association and the American Road Builders' Association, is to continue from Tuesday, September 14, to Friday, September 17, inclusive. On September 16 and 17 are to be held conventions of the four national societies of Civil, Mechanical, Mining and Electrical Engineers, each society meeting separately. Saturday and Sunday, September 18 and 19, are to be devoted to excursions to points of engineering interest in San Francisco and vicinity. The following week, from September 20 to 25, is given up to the International Engineering Congress.

Late News Items

Ailsa Craig, Ont.

A by-law has been carried providing for the installation of a hydro-electric system. Town Clerk, J. S. Smith.

Calgary, Alta.

The City Council have had plans prepared for two comfort stations, estimated to cost $14,000. Engineer, G. W. Craig.

Dufferin County, Ont.

Tenders on the construction of five concrete bridges will be received until 1 p.m., July 9th, by Wheelock & Christie, Engineers, Orangeville. Plans and specifications with the Engineers.

Elmwood, Man.

The following contracts have been let for the erection of a picture theatre on Kelvin Street for M. Gonsalves, 160 Eugene Street, Norwood:—masonry, Woodall & New, 54 McAdam Avenue; carpentry, Pattie & Cosham, 489 Victor Street; plastering, Cooper & Sons, care of Roberts & Frith, Engineers, Canada Building, Winnipeg; heating and plumbing, Jonees & Creighton, Harbison Ave.; electrical work, Schumacher Grey Company, 386 Donald Street; sheet metal work, Elm Sheet Metal Works, 20 Levis Street.

Exeter, Ont.

The Town Council will shortly submit a by-law providing for the installation of a hydro-electric system, estimated to cost $20,000. Acting Clerk, J. Senior.

Hagersville, Ont.

Tenders on the construction of concrete sidewalks will be received until July 12th by the Village Clerk, J. T. Park. Plans and specifications with F. E. Shildrick, Chairman of the Board of Works, and at office of the Clerk.

Hastings County, Ont.

The County Council have recommended the construction of a number of bridges. Clerk, A. M. Chapman, Belleville.

Montreal, Que.

Tenders on underground cables at the Flitration Plant will be received until noon, July 20th, by the Board of Commissioners. Plans and specifications at office of the Chief Engineer, City Hall.

Nanaimo, B. C.

E. J. Breseman is receiving tenders on plastering, plumbing, wiring, hot water heating, painting and decorating, marble and tile work, roofing and metal work, fire escapes, electric fixtures, stage equipment, opera chairs, mission tile, art and plate glass, and mirrors, for a theatre to be erected on Bastion Street.

Port Alberni, B.C.

The Presbyterian Church has been completely destroyed by fire. Loss, $6,000. Pastor, Rev. Thomas Oswald.

St. Vincent Township, Ont.

Tenders for concrete abutments for a bridge on the Eighth Concession will be received until July 10th by James A. Lemon, Meaford.

Toronto, Ont.

R. M. Mishaw, care of E. W. Mishaw, 269 College Street, has commenced the erection of a pair of residences at 52-54 Manor Road, estimated to cost $7,000.

Work has been started on the erection of two residences at 165-167 Glendennan Avenue, by T. W. Robinson, 11 Evelyn Crescent. Brick construction, shingle, felt and gravel roofing. Approximate cost, $5,000.

Vancouver, B. C.

G. B. Barker, 835 Tenth Avenue, has started work on repairs to a warehouse at 1150 Hamilton Street for J. W. Percival, Canada Life Building. Approximate cost, $22,000.

Local assessments for mosquito extermination in portions of New York City are authorized by an act of the New York legislature which is to take effect immediately. The act, which is an amendment to the city charter, as as follows:—

The cost and expense of the construction of drains upon or of other improvements to low or wet lands in the boroughs of Brooklyn and Queens, for the elimination of mosquitoes, by the board of health, shall be borne by the property benefited within an area of benefit to be fixed by the board of assessors, or such portion of the amount of such cost and expense as the board of health may determine and certify to the board of assessors. Assessments therefor shall be made by such board of assessors as provided in chapter seventeen of this act.

The flow of the Colorado River is sufficient to irrigate the entire Colorado delta, according to a report made by C. R. Rockwood, Chief Engineer of the Imperial Irrigation District. Twenty-three years ago, in 1893, Mr. Rockwood stated that the Colorado River furnished sufficient water to irrigate every acre on its lower drainage basin to which water could be applied. Data now available permit a much more comprehensive and complete report. Mr. Rockwood finds that the area which may be irrigated with the flow of the Colorado River at minimum stage varies from 4,672,000 acres in June to 829,000 acres in September. Below The Needles, Mr. Rockwood estimates that 1,700,000 acres may eventually require water. Long before this entire amount is brought under cultivation, however, it will be feasible to provide storage reservoirs on the upper tributaries of the Colorado for the impounding of flood waters; and with this done, the river can furnish an absolutely safe supply for the months of July, August, September, and October, which are the only months in which the normal flow of the river might be inadequate. His final conclusions are that the river without storage can irrigate 1,200,000 acres, and with 2,000,000 acre-ft. of stored water every available acre below the Grand Canon, including all lands in Mexico, could be irrigated. Even without storage and this entire area under irrigation, the worst that could happen in a year would be the loss of one or two cuttings in alfalfa on a part of the land. —Engineering News.

It is an old and doubtful saying that "lightning never strikes twice in the same place." When it does strike, however, it causes destruction and death. During the month of April, throughout central and eastern Ontario and western Quebec, no fewer than 61 buildings were destroyed or damaged by lightning. It is doubtful if any of these buildings were protected by lightning rods.

Isolated and exposed as they are to the danger of lightning, it seems remarkable that so few farm buildings are equipped with this cheap and efficient protection.

Lightning rods have proven their efficiency. Many buildings owe their protection entirely to the fact that they were rodded, and losses on these buildings have been reduced to a minimum. According to W. H. Day, Professor of Physics, of Ontario Agricultural College, "out of every thousand dollars' worth of damage done to unrodded buildings, by lightning, nine hundred and ninety-nine dollars' worth would be saved if those buildings were properly rodded." This opinion is based on data compiled from investigation and reports covering ten years and including a record of 599 buildings that were struck by lightning. Of these 317 were burned, or 53.6 per cent. Of the 599 buildings only 18 were rodded, and of these three were burned, or 16.6 per cent., as against 53.6.

When it is understood that the losses to the insurance companies in Canada, by lightning, approximate a halfmillion dollars annually, and that this represents probably less than half of the total loss, the necessity of more adequate protection to farm buildings is apparent.

Some records of lightning rod efficiency follow: In Ontario for 1912, 94½ per cent.; for 1913, 92 per cent.; in Iowa, for eight years, 1905-1912, 98.7 per cent.; in Michigan, inspected rods showed an efficiecy of 99.9 per cent. fof four years, 1909-1912, inclusive. These figures are worthy of the careful consideration of the residents of the rural districts of Canada.

Further information on the subject of lightning rods and their efficiency may be obtained in Bulletin 220 of the Ontario Department of Agriculture, supplied free to those interested.

Coal gas residuals form the bases of many industries. Owing to the great development of by-product coke ovens and gas plants in Germany and the application of modern chemistry to the utilization of their by-products, these industries have largely been controlled by that country. In the readjustment of industrial and trade conditions after the war, it is desirable that as many of these industries as possible be established in Canada and in other parts of the British Empire.

There are two large by-product coke ovens in Canada which produce 67 per cent. of our coke output. These plants are situated at Sault Ste. Marie, Ont., and at Sydney, N. S. Since the outbreak of war, the latter plant has been installing a benzol recovery plant, but, in Western Canada, there are numerous beehive coke ovens which do not save any by-products whatsoever. Again, while large quantities of tar are recovered from local gas plants, no industries have been established for the refining, separation and use of the products obtainable from it.

Not only is the saving of the by-products from the coking or carbonization of coal a measure of conservation, but the sale of these residuals is the means of reducing the cost of production in a degree corresponding to the efficiency of the recovery methods adopted and the market value of the products.

Tenders and For Sale Department

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Incandescent Lamps, Public Buildings, Ottawa, Ont., will be received at this office until 4 p.m., on **Tuesday, July 13, 1915**, for the work mentioned.

Tenders will not be considered unless made upon forms supplied by Department and in accordance with conditions contained therein.

Specifications to be seen on application to Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Toronto, to Mr. R. L. Deschamps, Overseer, Dom. Bldgs., Montreal, and to the Chief Architect, Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender.

By order,

R. C. Desrochers,
Secretary.

Department of Public Works,
—81952. Ottawa, June 28, 1915. F

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Superstructure of the North Timiskaming Bridge, Que.," will be received at this office until 4 p.m. on **Monday, July 12, 1915**, for the construction of the superstructure for a bridge consisting of four spans, over the Quinze River at North Timiskaming, Pontiac County, Que.

Plans and forms of contract can be seen and specifications and forms of tender obtained at this Department and at the offices of the District Engineers, Shaughnessy Building, Montreal, P. Q.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Hamilton, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

Note.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 19, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—80239. 27

Tenders Wanted

Tenders will be received up to 6 p.m. **Saturday, July 17th,** for the construction of the substructure and superstructure of a Highway Bridge over the Madawaska River at Burnstown in the County of Renfrew, Ontario; tenders to be addressed to P. H. Bolger, Chairman Roads and Bridges Committee for the County of Renfrew, R. M. D. No. 2. Renfrew, Ontario.

Plans and specifications may be seen at the office of J. L. Morris, County Engineer, Pembroke, and J. A. Devenny, Town Clerk, Renfrew, Ont., on or about the 1st July, 1915.

The lowest or any tender not necessarily accepted.

ROBERT J. RONEY,
27 28 Clerk of the County of Renfrew

TOWN OF OAKVILLE

Pumping Machinery

Sealed tenders will be received by the Chairman of the Oakville Water & Light Commission until **8 p.m., on Monday, July 26th, 1915**, for furnishing and installing one electrically-operated turbine pump of 600 Imperial gallons capacity against a head of 300 feet.

It will be necessary for bidders to visit Oakville and inspect the existing pumping station.

Specifications may be seen at the office of the Commissioners, Oakville, or at the office of the Engineers, 204 Mail Building, Toronto.

The lowest or any tender not necessarily accepted.

C. G. MARLATT, Esq.,
Chairman, Oakville Water & Light Commission

CHIPMAN & POWER,
27 Engineers.

Tenders for Construction of Bridges

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Tuesday, July 20th, 1915**, for the construction of:

1. Reinforced Concrete Slab Culvert of 12 ft. span, between North Guillimbury and Whitchurch Townships, Con. VI., in the County of **York**.
2. Reinforced Concrete Slab Culvert of 12 ft. span, between North Guillimbury and Whitchurch Townships, between Con. VIII. and IX. East, in the County of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
County Engineer.
Toronto, June 29th, 1915. F

FOR SALE

Complete shop outfit, consisting of:—
One 10 x 15 Iron Shaper;
One Pedestal Emery Stand;
One 20-in. Square Base Champion Drill;
One 14 x 28 Fay & Scott extension gap lathe;
One 8 H.P. Gasoline Engine;
Together with belting, shafting, hangers, and pulleys.

This machinery in first-class condition. Box 213, Contract Record, Toronto. 25-27

Mixer Wanted

Concrete batch mixer, also heavy timbers and scantling, second-hand. Give full particulars and price. Box 221, Contract Record, Toronto. 27

In many cities and towns of Canada, the annual clean-up day has been observed. Refuse and litter have been removed. Yards have been tidied up and made presentable. This result has been secured through the active agitation of public bodies and private individuals interested in the sanitary and clean-city movement.

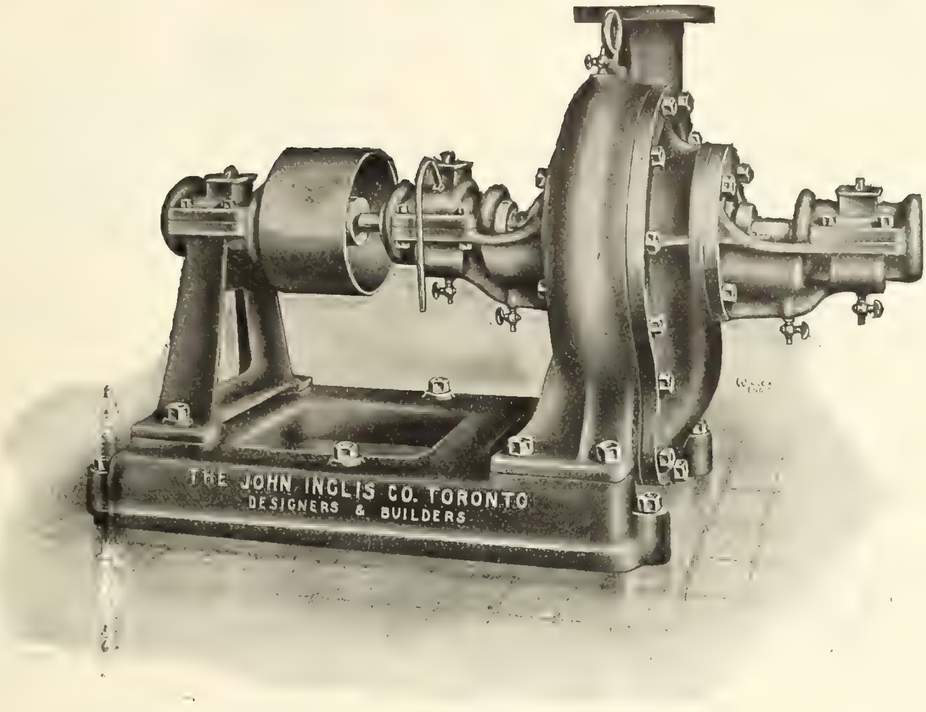
But why should this lautlable effort be restricted to annual clean-up days?

In Canada, owing to the conerivg mantle of snow which hinders the complete remoal of garbage and other refuse, there is some slight excuse for the untidy conditions found in the spring. As this excuse is not applicable, however, during at least eight months of the year, there is no reason why, after the spring clean-up, the improved conditions should not be continued.

The cultivation of civic pride is a necessary factor in the clean-city objective. The officers of municipalities, and especially the newspapers, have it in their power to create and foster this spirit of pride. With the incentive of respect for the home town, it becomes a duty of first importance on the part of its residents to see that its roads, sidewalks and open spaces are kept clean, to protect its trees, and in every way possible to preserve and beautify their homes.

The proper interpretation of forestry, and what it actually means to Canada, cannot be stated too frequently. The future of this country depends upon our making every acre productive. Broadly speaking, the earth's surface can be made productive in two ways only, by producing agricultural or timber crop. South of the 60th parallel, about 69 per cent. of the area of Canada is unsuited for agricultural crops. A very large proportion of this non-agricultural land is suitable for the production of merchantable timber. The production of forest products has been and will always be one of our chief industries. At the present time forest industries supply 12 per cent. of our foreign trade, 16 per cent. of our railroad traffic, and equal in value our annual wheat crop. We have a choice to make. Shall we let these valuable industries perish for want of raw material or shall e perpetuate them by protection of our present mature timber from fire, by protection of the young forests of our non-agricultural lands, and by the logging of our forests in such a manner as to encourage the reproduction of valuable forests? The perpetuation of these raw material by the investment of such expenditure as the anticipated crop will warrant is forestry.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

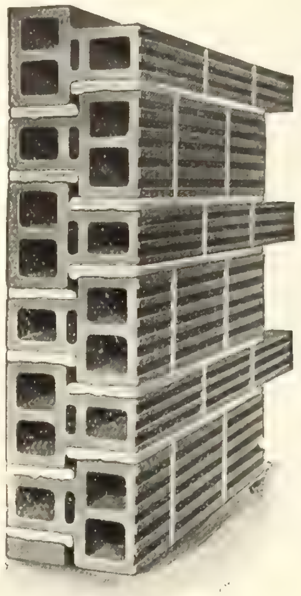
INGLIS' PRODUCTS ARE "MADE IN CANADA"

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Montreal Office: Room 509 Canadian Express Building
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Denison Interlocking Hollow Tile Assures "Safety First" in Building



Eight Inch Wall
Builds like a Thermos Bottle

Safety in construction because of its bonding and interlocking features which are unequalled by any other tile.

Safety in a healthful way because no moisture can seep in. There are no mortar joints extending through the wall.

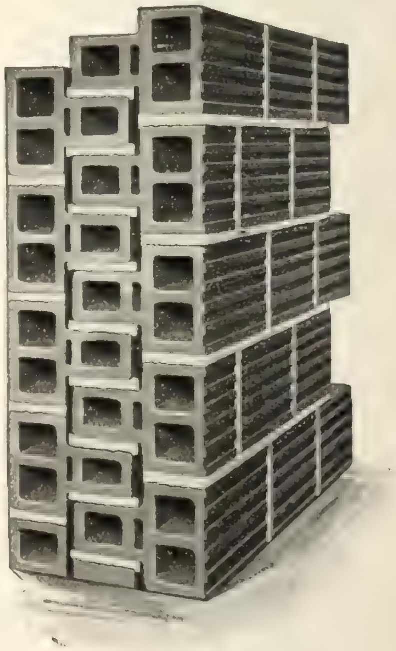
Safety in the matter of heating for the dead air spaces insulate it against heat and cold.

Safety in fireproof features.

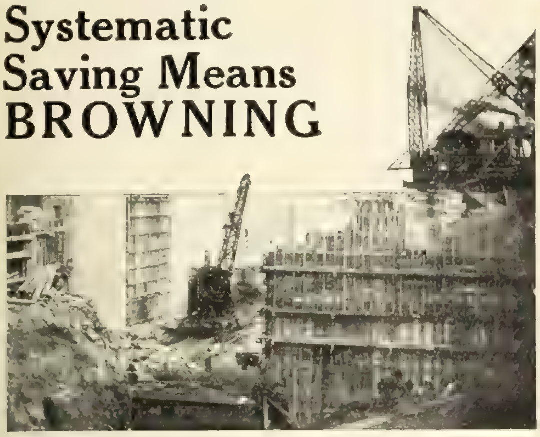
Canadian builders should specify Denison Interlocking Hollow Tile because it's well made in Toronto, Canada.

SUN BRICK CO., Limited
The One Price Company
Traders Bank Building TORONTO, ONT.

Montreal Agent : **HYDE & SONS, LIMITED**
12 Bleury St.



Twelve Inch Wall
Builds like a Thermos Bottle.



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Sometimes your concrete is to be placed at some distance from the mixer. Here a Browning Locomotive Crane is a money-saver. It can handle full concrete buckets at very long radii and at a total expense of but 2c. per yard. You use but one man, doing away with a dozen or more men and wheelbarrows, and you handle as much or more material. Besides the crane is always there; labor is sometimes hard to get and to keep. We have interesting photographs of work like yours. Write us for them; they are free.

The Browning Company, Cleveland, O.

Sales Offices :
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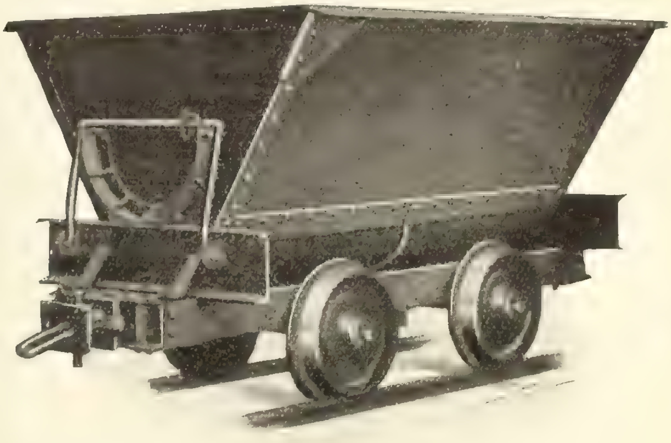

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17 ft. Austin Mixer, Engine and Boiler, on wheels. Elevator attachment for loading. Price $450.

1 Locomotive Crane, 15-ton, 8 wheel, 50 ft. boom. A very attractive price for quick sale.

2 Model 60 Marion Shovels at $5,000 each.

15-25 ton dinkies, standard gauge; 28 flat cars, 60,000 lbs., want offer; 2 locomotives, 1 40-ton, 1 55-ton; 100 6-yd. cars, standard gauge; 12 4-yd. cars, 36-in. gauge; derricks, steel and wood; concrete mixers; rock crushers; motors, ¼ h.p. to 200 h.p.; transformers, hoisting engines; pumps, all sizes; 800 tons of 56-pound relaying rails; 50 tons of 25-pound relaying rails.

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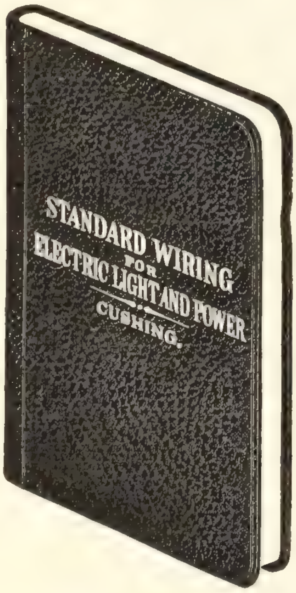

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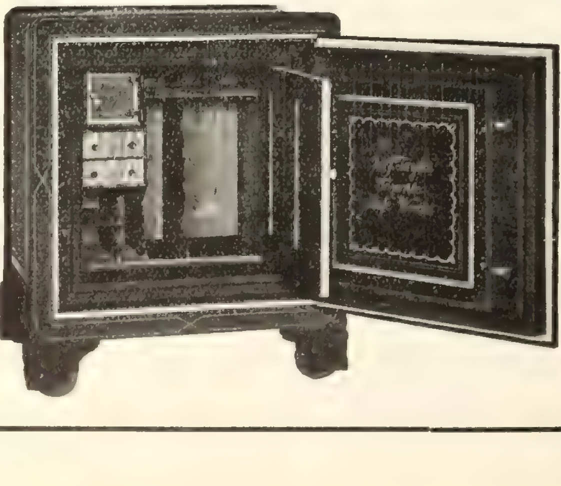

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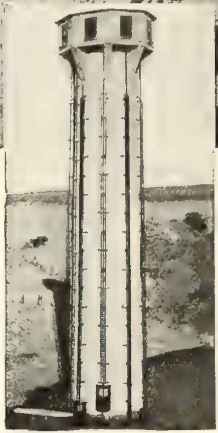

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This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

- Centrally located at Adelaide and Charlotte Streets.
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Engineers and Contractors

The following Books are Offered subject to Previous Sale:

British & Foreign Building Stones, by John Watson, Published in 1911 at the University Press, Cambridge, England. 483 pages. Price 50 cents.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

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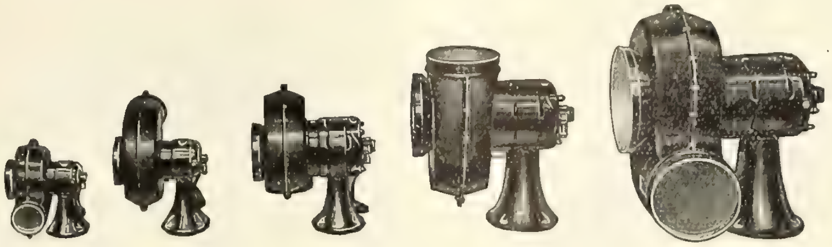

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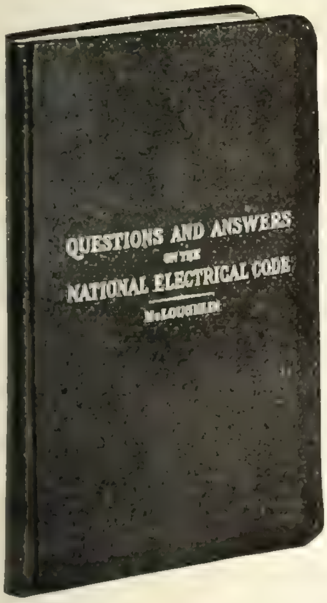

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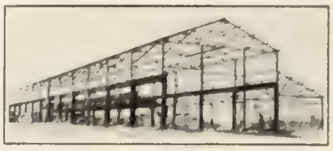

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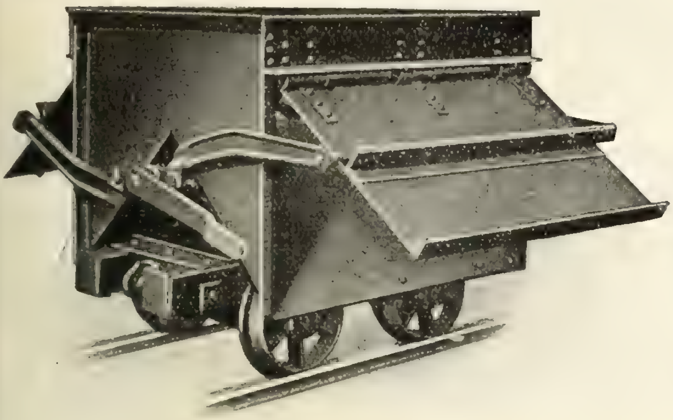

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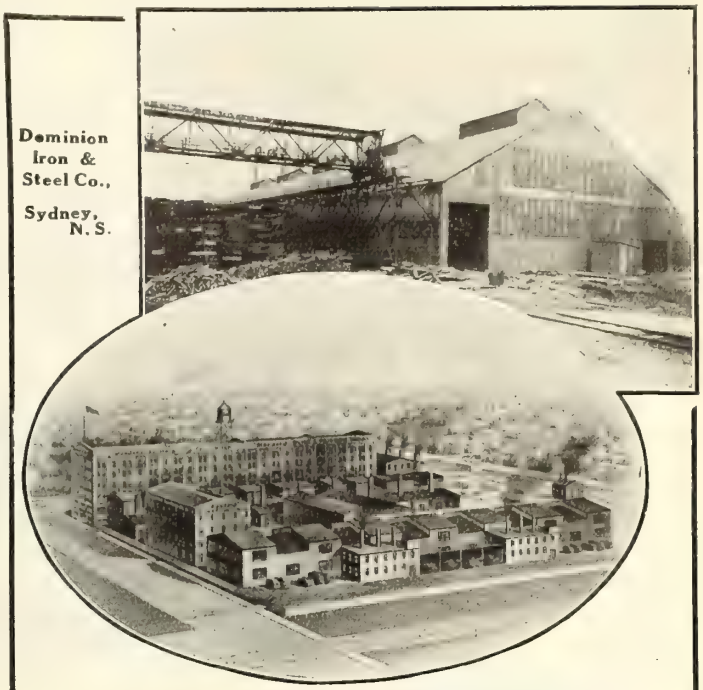

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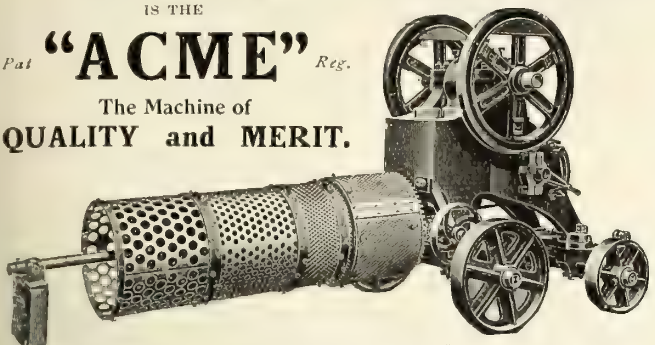

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The Electric Steel & Metals Co., Limited
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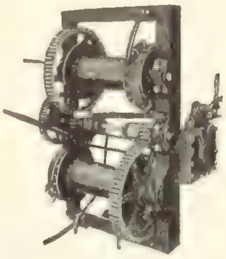
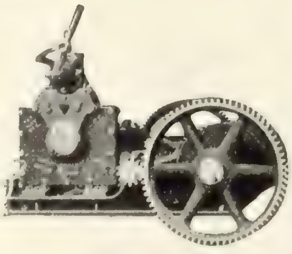


Motor Crab

Write for catalog and prices

Dake Engine Co.

Grand Haven, Mich.



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Ornamental Lighting Poles

During the past few months we have supplied ornamental lighting standards for the following places:—

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Windsor, Ontario
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London, Ontario
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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

William Hamilton Company

Peterborough, Ontario

The contract for the new Half Million Dollar Civic Library at Montreal has been awarded in

"Queenston Blue" Limestone

Specify and get the best Canadian Stone.

The Queenston Quarry Co., Ltd.

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Sales Agents: Toronto, Geo. W. Britnell, Builders' Exchange.
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Sole Manufacturers under Canadian and U. S. Letters Patent

Toronto - Canada

Cawthra Mulock, President Gordon F. Perry, General Manager

NATIONAL IRON WORKS, Limited

Head Office, Works and Docks:—TORONTO

every size for Water, Gas, Culvert or Sewer, Carried in Stock at

Lake or Rail Shipments TORONTO and PORT ARTHUR

Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of terrific usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

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Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

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Big satisfaction with "Empire" Corrugated Iron

It always gives you a perfect job, because every sheet is true and straight, absolutely unform and snug-fitting. "EMPIRE" CORRUGATED IRON is made from tried and proven metal. Talk the value of fire-proof, repair-free construction and use "Empire" brand and you've got a money making combination.

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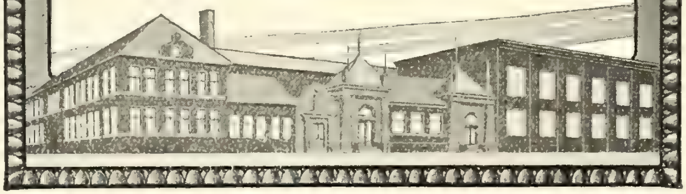
Toronto — Manufacturers — Winnipeg



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TRIDENT Frost-Proof Water Meters

Write for Catalogue

Main Office - 90 West Street

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Ideal Municipal Incinerator

Was officially opened at

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Clinkering doors of furnaces and clinker car.

This Ideal High Temperature Destructor during the demonstration test consumed 15 tons of garbage in 8 hours, and one horse, weight 1385 lbs., in 20 minutes.

The Ideal Incinerator and Contracting Company designed and built the whole plant, including Building, Furnaces, Flues and Chimney, by their own expert men.

Plant was commenced on Feb. 28th, 1915, and was completed April 28, 1915, in record time. This was accomplished during zero weather, not deducting bad weather.

Capacity of plant 30 tons per day.

This plant is fire proof throughout.

Write for full information.

No. 2 Manning Arcade Annex, Toronto

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5 barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long. $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.75; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. net cash. Copper bearing sheets—Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13½c basis; African hemp, 13½c; sisal rope, 10½c basis; lath yarn, 9¾c. Boiled linseed oil—in barrels, 80c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20. Bags 10 cents extra.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 72)

RAILS BILLETS

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY LIMITED

BAR STEEL

Warehouse Stocks:
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WIRE NAILS and other WIRE PRODUCTS

"Pillar Brand"
Hardwall Plaster

"Pillar Brand" hardwall plaster is made from the purest Nova Scotia Rock, calcined and prepared by expert workmen under experienced supervision.

"Pillar Brand" plaster is mixed with the highest grade goat and cattle hair, thoroughly washed and specially prepared.

We also make cement plaster, whitewall finish, plaster of paris, and land plaster. Shipments by rail or water.

Write us for prices.

The Iona Gypsum Co., Limited

Head Office, Sydney, N. S. *Mills,* Iona, N. S.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page (70)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $11.50 per 100 lbs.; boiled linseed oil, in bbls., 98 cents per gal.; raw linseed oil, in bbls., 95 cents per gal.; dry red lead, $10.00 per 100 lbs.; putty in bulk, $3.25 per bbl.; putty in 25-lb. tins, $3.75; turpentine, in bbls., 80 cents per gal. Mixed paint, ordinary colors, per gal., $3.10.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 350 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35 in car lots, $40 in warehouse; fire clay, $12 per ton in car lots.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galavanized iron—28 gauge, $5.75 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warenouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.

Burlington Steel Co.
(Formerly Canada Steel Co., Ltd.) Limited
Hamilton, Canada

STEEL BARS
for Reinforcing Concrete

Rounds, Squares, Flats, Twisted Squares, Angles, T-Bars,
Ovals, Half Ovals, Half Rounds, Bands, Special Sections.
3/4″, 7/8″ and 1″ Channels for use with Metal Lathing

CROSS ARM BRACES—POLE SHIMS
Plain and Galvanized

Prompt Shipment from Stock

"Come and take a look at the 9 x 12 you furnished us, it is doing fine work."

Mighty nice to be greeted in the above manner, particularly gratifying because the Engine was handling a big clamshell continuously—which as you know is one of the hardest forms of service—and the speaker a man of broad experience.

We can fill your requirements just as satisfactorily.

Hoisting and Material Handling Plant is our specialty.

Let us have your inquiry for whatever you need in the way of HOISTS, CLAMSHELLS, PUMPS, DERRICKS, DREDGES, Etc.
We can interest you.

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E. LEONARD & SONS .... St. John, N.B.
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LIMITED

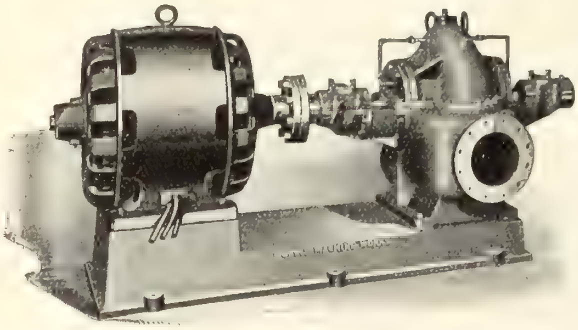
Manufacturers of

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

CAST IRON PIPE

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

HAMILTON, ONT.



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RANSOME

Drifting Sand Filters

THIS system has been accepted by the City of Toronto after a thorough test, and a plant having a daily capacity of 60 million imperial gallons is now under construction. The filters can be installed in either the gravity or pressure systems.

Designs and estimates furnished on application.

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154 Simcoe Street, Toronto

The Canada Iron Corporation, Limited

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Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

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A double automatic Brake Dumbwaiter
Automatic two ways. UP and DOWN.
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Write us for particulars.

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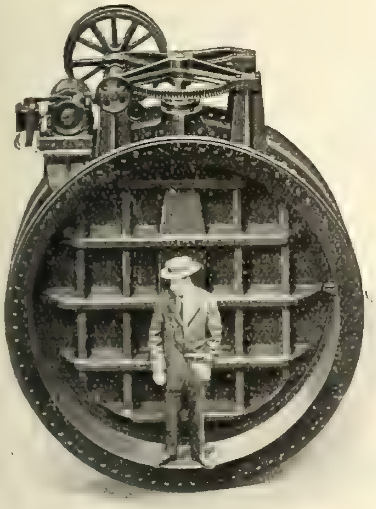

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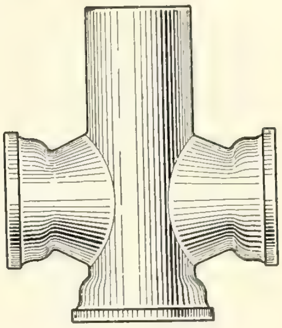

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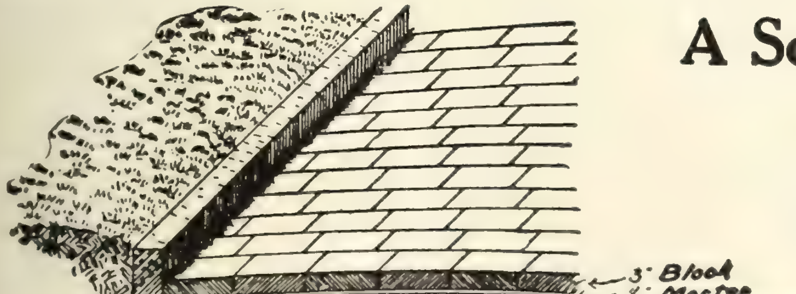

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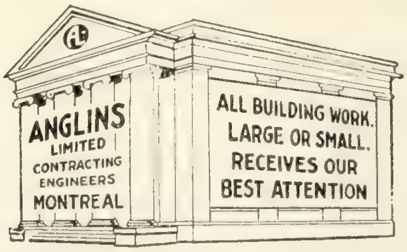
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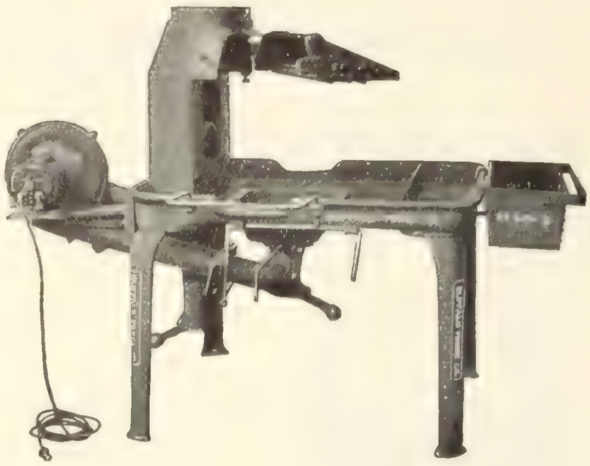

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"Canadian" Down Draft Electric Forge

No. 681-E

Embodied with the Down Draft Feature of this forge is the Swing-Over Hood. This permits of heating work too large to go under standard hoods.

It is equipped with Electric Blower No. 2E.H. either **Variable Speed** with 6-speed regulator or **Constant** Speed with Blast Gate regulation. Also fitted with our **R. R. Tuyere Iron,** 5 inches deep and 12 x 14 inches over all. The revolving **Ball Valve** gives close control of the fire and quickly breaks and cleans out clinkers and ashes, which escape through the balanced **Ash Gate.** Size of hearth 38 x 42 in., weight 775 lbs.

Write for further particulars concerning this highly efficient Forge.

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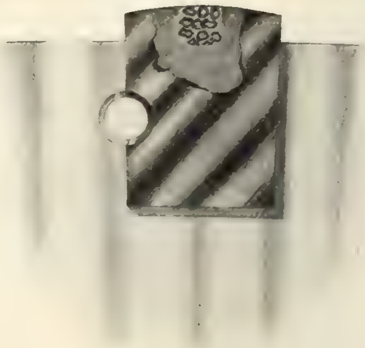

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After costly experimenting, we have produced a Saw Tooth which enables diamond saw owners to reduce their cutting (independent of labour) by 50 per cent.

This Tooth is the "ANDERSON REINFORCED DIAMOND SAW TOOTH."

This Tooth contains, instead of one solid diamond, a number of small pieces making up the same weight. The double advantage being that it COSTS LESS and LASTS LONGER.

With the Reinforced Diamond Tooth the diamond is inserted in a broken condition, and perfectly reinforced with steel. As the tooth wears down only small pieces can go to waste, mere dust, and it is impossible for them to suffer loss through entire or partial breakage so common with teeth cutting the harder building stones.

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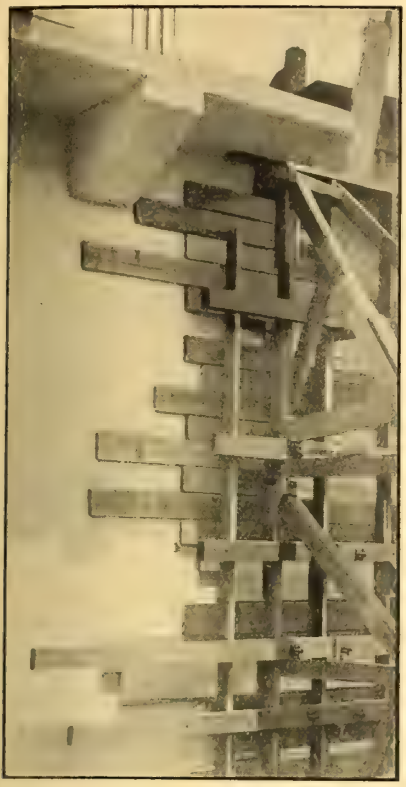

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Look at the illustration and contrast this strong sure wire clamp with the old and inadequate method of clamp forms.

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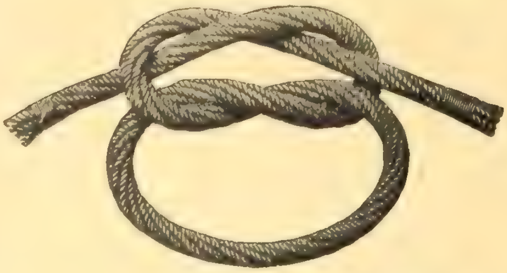

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Concrete
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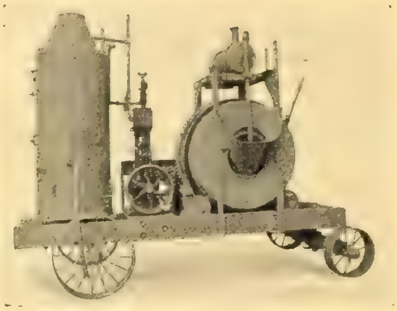

When deciding upon a special concrete plant, let us quote you for a mixer that will fulfil all your needs.

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Steam
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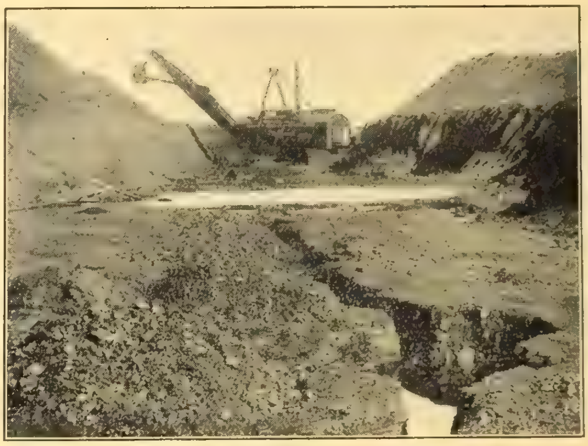

We supply "Marion" Shovels, Drag Line Excavators, Railroad Ditchers and Dredges in all sizes and styles—for all classes of work.

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Loco-
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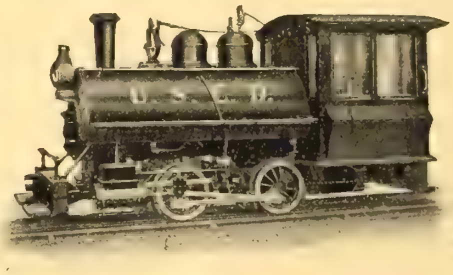

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Vol. 29 Toronto, July 14, 1915 No. 28

ESTABLISHED 1886

Contract Record and Engineering Review

American Steel and Wire Company

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Renders Concrete Roads
Most Durable

Minimizes possibility of cracks caused by temperature changes and non-uniform sub-soil.

Positively adds to the life of the road, as well as greatly reducing the cost of maintenance.

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Warehouse Stock carried in Toronto and Montreal.

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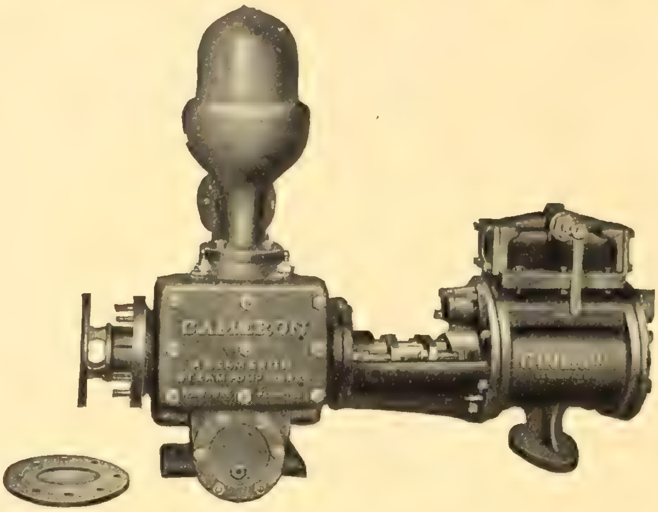

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Throughout Canada

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Of the thousand-and-one articles of rubber which we manufacture, practically all are used by us in our own offices, in our own factories, or in our own homes.

WE TAKE OUR OWN MEDICINE

Our line-up is complete, our quality is unexcelled and our prices are right. Let us show you what we can do.

It is our desire to serve you.

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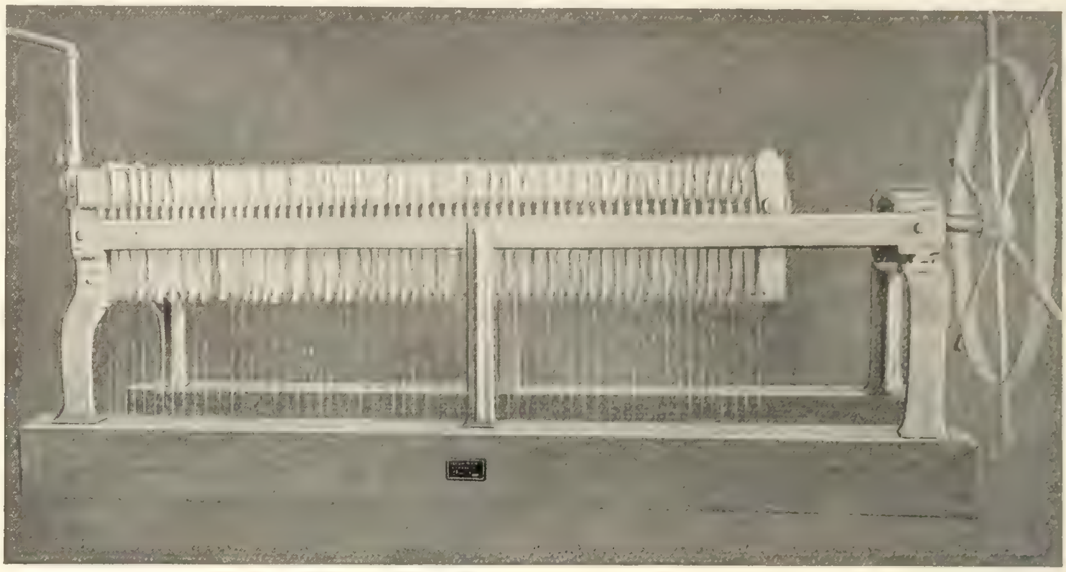

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Constructed in such a way that the clay can be removed from under the press, thus obviating any possibility of grease becoming mixed with the clay, as is common with other types of presses where the clay has to be lifted out over the side rails. This press will save 50 per cent. in the cost of filter press cloths as compared with other presses. Can be furnished with a hand wheel, as in illustration, or with a ratchet attachment. Made in various sizes with capacities from 60 to 4,500 pounds.

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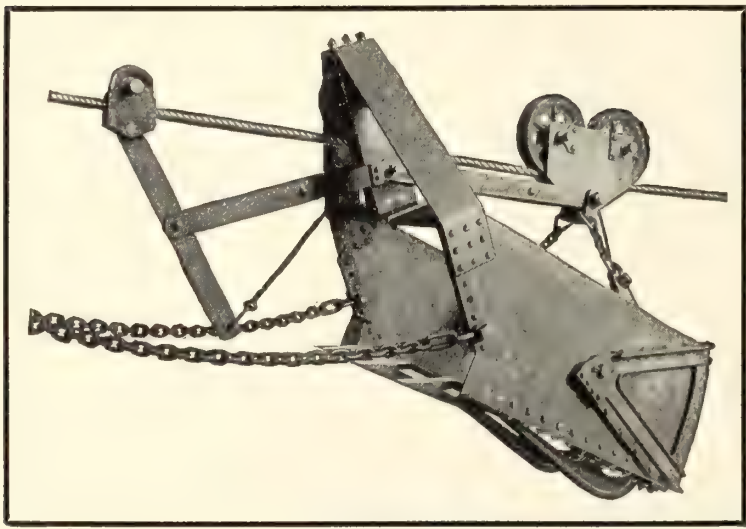

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Dull Company, Raymond W.
Hopkins & Co., F. H.
Pawling & Harnischfeger

Exhaust Heads
Canadian Blower and Forge Co
Sheldons Limited

Engines
Canadian Blower and Forge C
Can. Fairbanks-Morse Compan
Hopkins & Co., F. H.
Inglis Company, John
Laurie & Lamb
McDougall Caledonian Iron Wks
Rock & Power Machinery Co.

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Cape Company, E. G. M.
Chipman & Power
Dominion Engineering & Insp tion Company
Farmer, John T.
Galt Engineering Co., John
R. S. & W. S. Lea.
McDougall, Geo. K.

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Pedlar People Limited
Trussed Concrete Steel Co.

Fans
Sheldons Limited
Sturtevant Co. of Can., Ltd., B. F

Fire Hose
Can. Consolidated Rubber Co.

Filtration Plants
verMehr Engineering Co., Jo

Fireproof Doors and Windows
Hope & Sons, Henry
Ormsby Company, A. B.
Pedlar People Limited
Steel & Radiation Limited
Trussed Concrete Steel Co.

(Continued on page 12)

Largest Steel Guy Derrick In Canada

Made in Canada—By the Power of Niagara

Capacity—35 tons **Mast—90 ft.**

Boom 75 ft. **Bull Wheel—16 ft.**

High class steel derricks of large capacity are our specialty, all sizes from 5 to 50 tons.

Electric Hoists—Cranes—Derrick Irons

Stone and Marble Working Machinery

POLLARD MFG. CO.
LIMITED
Niagara Falls, Canada

Have Your Building Daylighted

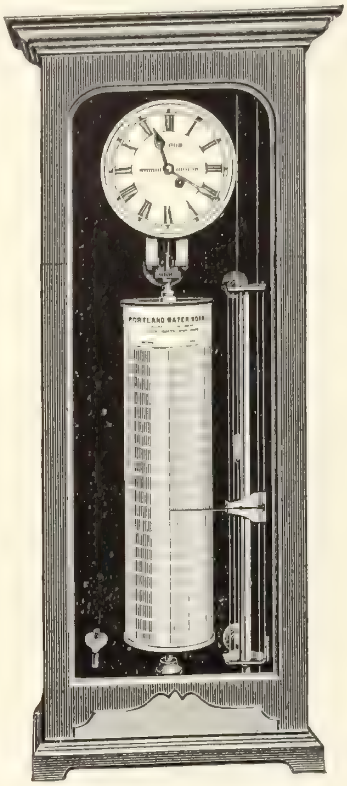
While it is not possible to have every part of your building daylight it is practical to have some portions of most buildings daylighted. The one best way to accomplish result in daylighting is by the use of

LUXFER PRISMS

These are made up of a number of accurate formed prismatic angles that are capable of refracting daylight and putting it where it is wanted.

Always specify the first and best prism—LUXFER.

LUXFER PRISM COMPANY, LIMITED
100 King Street West, Toronto, Ont.



The rise and fall of water in a Reservoir, Tank or Well can be accurately recorded in the Engineers Office, even if it is fifty miles away. The Transmitter will show locally the variation, and will send impulses to the Recorder for every inch rise and fall. The Recorder will show all this on the chart and the pen acts as a graphic indicator, and enables the level of the water to be seen at a glance.

The complete outfit, without batteries or line wires, with one year's supply of charts delivered free, duty paid any town in Canada

$350.00

Gent & Co., Ltd.
Leicester, Eng.
Cables, Lodestone

KERR
Gate Valves
and
Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO

8 x 8 x 24 inch Granite Rock Face Block

Molds for Casting

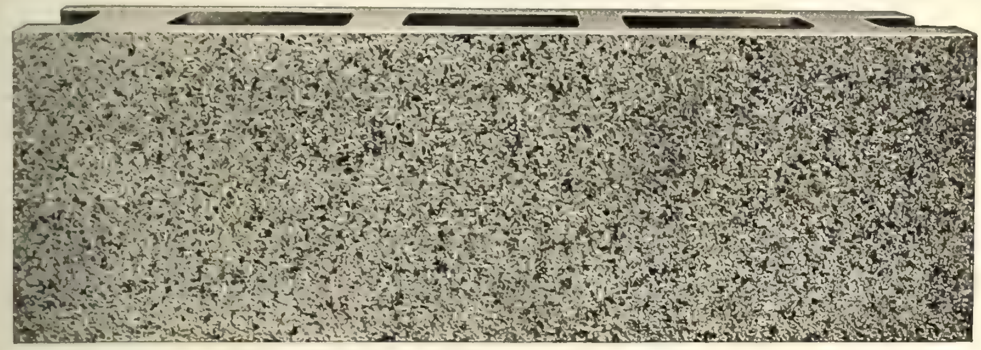
Waterproof Hollow Cement Building Blocks

With Granite Faces

THEY COST LESS — THEY SELL FOR MORE

YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited (Zagelmeyer System)

298 Howard Avenue, WINDSOR, ONTARIO

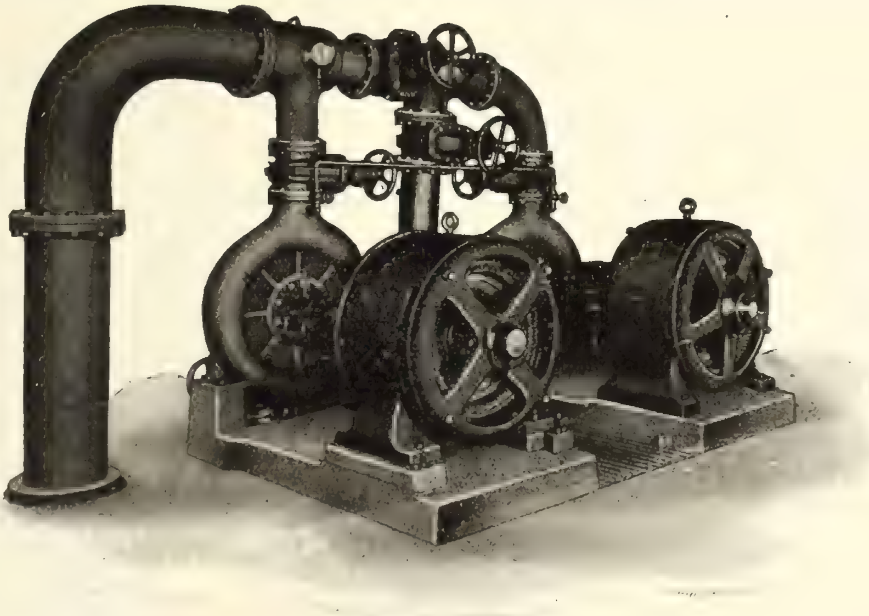
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

from

Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.

Limited

KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

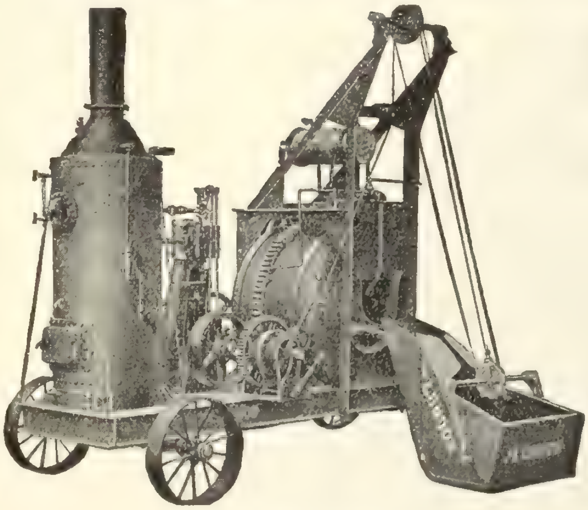
N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.

LONDON Batch Mixers

London Batch Mixers cost less because they will **run for years without repairs,** or break-downs. They produce more Concrete, they **make better concrete** and **do it in less time.** These features mean **clear profits** to the Contractor instead of loss.

Every Mixer Sold Sells Ten More. 2000 Now in Use.

Made in all sizes from ¼ yd. to 2½ yd. Batch. Get prices now before starting on the next job.

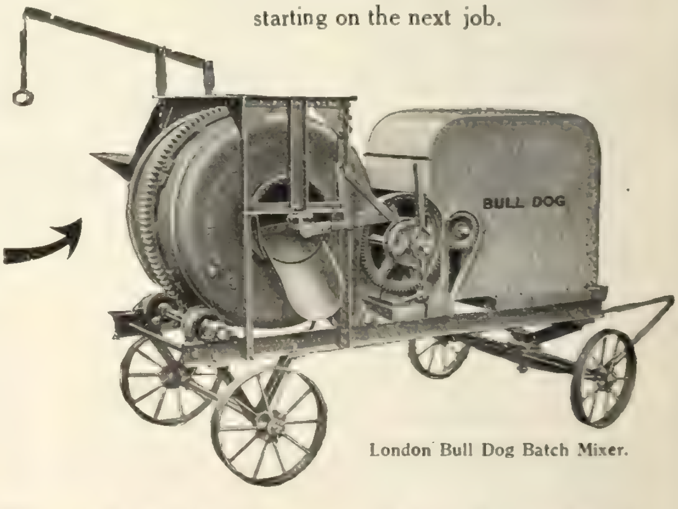


London Batch Mixer

Send for Catalogue No. 1.

LONDON BULL DOG BATCH MIXER

A Small Batch Mixer for Small Contract Work. 6 cu. ft. Batch, 50 cu. yds. per day. Can be operated with less men than any other Mixer. **Pays for itself in 15 days' use. Every contractor with small jobs should own a Bull Dog Batch Mixer.** Send for Catalogue No. 1B.



London Bull Dog Batch Mixer.

We make 23 different sizes and styles of Concrete Mixers also a full line of Concrete Machinery and Cement Working Tools.

London Concrete Machinery Co., Limited, London, Ont.

Branches and Agencies in every large city in Canada.

WORLD'S LARGEST MANUFACTURERS OF CONCRETE MACHINERY AND CEMENT WORKING TOOLS.

Brick, Stone, Cement and Concrete Surfaces

(except floors) can be preserved and beautified, and given a pleasing, uniform appearance, by the application of the Toch Brothers'

"LIQUID KONKERIT"

A Liquid Cement Paint in colors for Interior and Exterior use.

This material not only decorates, but preserves and weather-proofs, the surface to which it is applied, and eliminates that coarse, dirty, ugly appearance so common to ordinary re-inforced concrete work. Saltpeter will not come to the surface of walls treated with "Liquid Konkerit."

Light wells, passage ways, interiors of factories—

wherever the maximum of light is required—should be coated with "Liquid Konkerit Primer" followed by a finish coat of White "Liquid Konkerit" or Flex-Sicco ready mixed paint.

"Liquid Konkerit" is supplied in seven standard shades, besides white, but can be made in any desired color on special order.

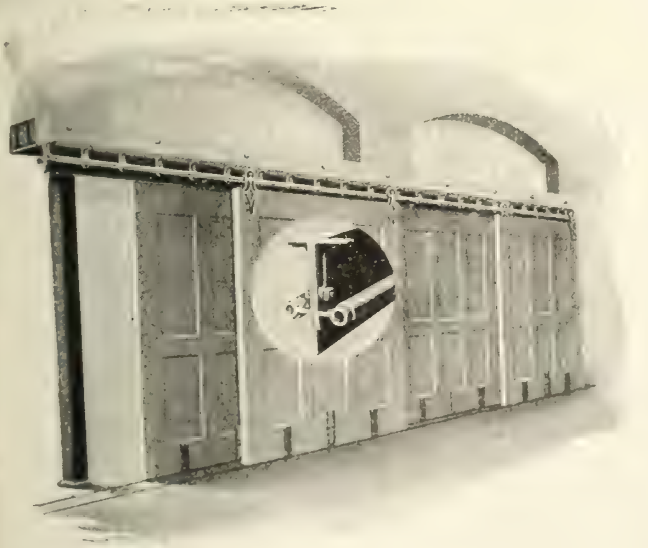
The new "Liquid Konkerit" booklet thoroughly describes this material and shows the attractive shades in which it is supplied. May we send you a copy?

Manufactured in Canada by

"R. I. W." DAMP-RESISTING PAINT CO. 202 Mail Bldg., TORONTO
Factory, Oakville, Ont.

DISTRIBUTORS:

Black Building Supply Company, Limited, Toronto
Dartnell, Limited, Montreal
Western Paint Company, Winnipeg
Canadian Equipment & Supply Company, Limited, Calgary and Edmonton



We can supply you with Hangers to carry any size door and **Parallel Equipment** in the **strongest style** of track.

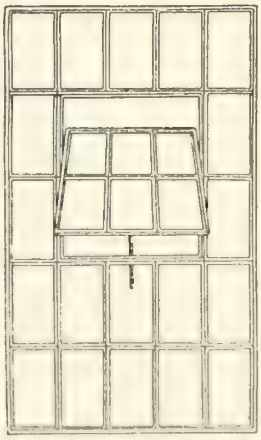
The Round Track with **Adjustable Supports.**

Manufacturers of
The best goods in the hanger line

ALLITH MFG. CO., LIMITED
HAMILTON

The Ormsby-Lupton Steel Sash

The Superior Steel Sash



Gives Fire Protection

Lowers Insurance Rates

Can be purchased very little in advance of the price of Wooden Sash.

Send for Catalogue and Prices.

A. B. Ormsby Company, Limited
TORONTO
Associated with
The Metal Shingle & Siding Co., Limited
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Browning Company
Canadian Ingersoll-Rand Co.
Gillis & Geoghegan
Goold, Shapley & Muir Co.
London Concrete Machinery Co.
Marsh & Henthorn
Morris Hoist & Crane Co., Herbert.
Northern Crane Works
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Pawling & Harnischfeger

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Hopkins & Co., F. H.
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Sheldons Limited
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Steel & Radiation Ltd.
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Metallic Roofing
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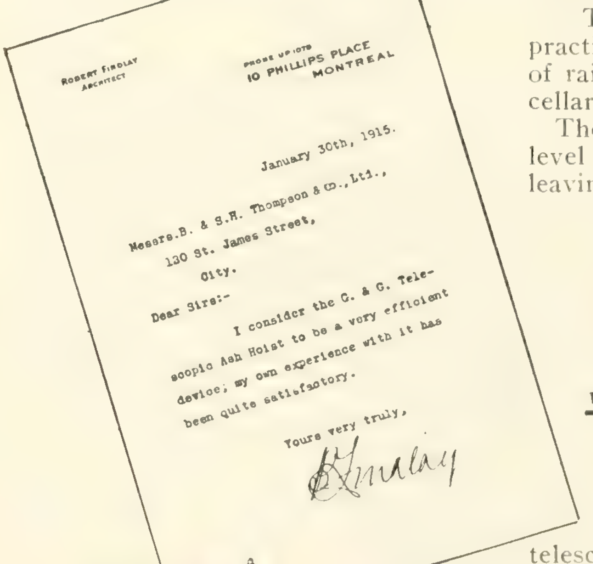
National Iron Works
Pacific Coast Pipe Co.
United States Cast Iron Pipe Co.
Vancouver Wood Pipe & Tank Company
Warren Foundry & Machine Co.

(Continued on Page 14)

A "One-Man" Ash Hoist

The G & G Telescopic Hoist is so designed that it is practical for one man unaided to perform the entire operation of raising ash cans to sidewalk and lowering empty cans to cellar.

The operator standing at sidewalk level can raise 4 or 5 cans without leaving the sidewalk.



ROBERT FINDLAY
ARCHITECT

PHONE UP 1079
10 PHILLIPS PLACE
MONTREAL

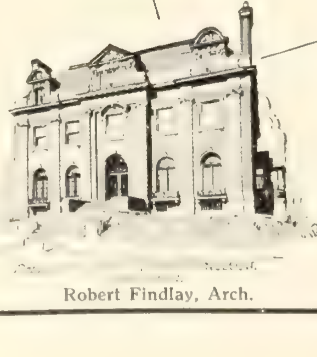
January 30th, 1915.

Messrs.B. & S.H. Thompson & Co.,Ltd.,
130 St. James Street,
City.

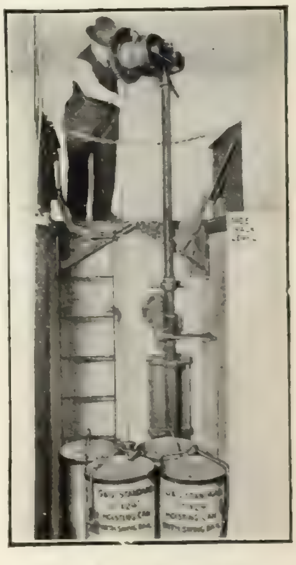
Dear Sirs:-

I consider the G. & G. Telescopic Ash Hoist to be a very efficient device; my own experience with it has been quite satisfactory.

Yours very truly,
R Findlay



Robert Findlay, Arch.



The G&G Telescopic Hoist
PATENTED
with compound gear and brake attachment

Raises a maximum load of 500 lbs. at a guaranteed speed of 30 feet per minute.

When not in use, hoist telescopes and no part shows above street level. This hoist is fitted with a patented "silencer," making it absolutely noiseless in operation. It can be installed in any building, old or new.

Write to our nearest agent for booklet and prices "Made in Canada"

GILLIS & GEOGHEGAN, Sherbrooke Que.

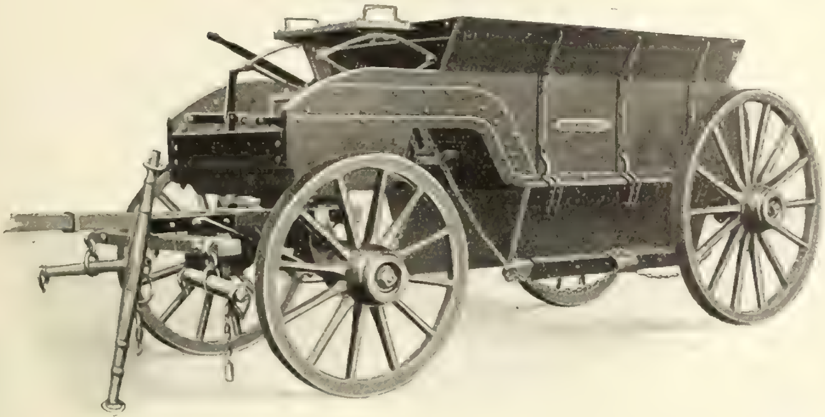
Black Building Supply Co., Ltd.
Agents for Ontario
Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

W. T. Grose, Agent for Manitoba, Saskatchewan, Alberta, Winnipeg

"MADE IN CANADA"



The "CHAMPION" Dump Wagon

Champion Road and Contractors Outfits
A complete and varied line of all machines for
Road Building and Street Work

CHAMPION DUMP WAGONS

Capacities:
1-1/2 Cubic Yards.
2 Cubic Yards.

If you are looking for a good Dump Wagon, you cannot afford to overlook the CHAMPION.

Selected materials are used throughout, and very careful consideration is given to the details of construction as well as to the workmanship. We can guarantee the **Champion** Dump Wagon to do what any other Dump Wagon will do and "do it longer."

Detailed information and catalog upon request.

Manufactured by
The Dominion Road Machinery Company, Limited
Goderich, Ontario

Macadam Roads

must be built of a
Tough Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Paints (Bridge and Structural Iron and Pipe Coating)
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  - Turbine Equipment Company
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  - Gartshore, John J.
  - Hopkins & Co., F. H.
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  - Asphalt & Supply Company
- Reinforcements, Concrete & Steel
  - Burlington Steel Company
  - Canada Wire & Iron Goods Co.
  - Dominion Iron & Steel Co.
  - Pedlar People Limited
  - Steel & Radiation Ltd.
  - Trussed Concrete Steel Co.
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  - Dominion Road Machinery Co.
  - Exeter Mfg. Co., Ltd.
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  - Hope & Sons, Henry
- Roofing Material
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  - Can. H. W. Johns-Manville Co., Ltd.
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  - Can. Consolidated Rubber Co.
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  - Can. Consolidated Rubber Co.
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  - Rogers Supply Company
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- Smoke Stacks
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  - DesMoines Bridge & Iron Co.
  - Hamilton Mfg. Co., Wm.
  - MacKinnon, Holmes & Co.
  - Manitoba Bridge & Iron Works
  - Pittsburgh-DesMoines Steel Co.
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ARTIFICIAL MARBLE

Made in Canada

ARTIFICIAL MARBLE is a material manufactured by a new process. The ARTIFICIAL MARBLE is harder than natural marble, is less absorbent and is susceptible to a higher finish. The coloring is non-fading and runs entirely through the marble.

ARTIFICIAL MARBLE is polished (not varnished) in the same manner and with the same material as natural marble.

ARCHITECTS:—Patronize a home industry and specify ARTIFICIAL MARBLE made by a Canadian firm, and with Canadian material.

We manufacture ARTIFICIAL MARBLE in all the beautiful colorings of the Italian, Greek, French and Belgian marbles, and the well known Canadian and American marbles, and our facilities are adequate to turn out the largest contracts.

Specify ARTIFICIAL MARBLE and avoid delays caused by the unsoundness of natural marble quarries.

Manufactured by

J. E. CARREAU

Office and Factory, 13 Notre Dame St., East

Phone Main 427-428—Connecting All Departments

MONTREAL

CRUSHED STONE

Good Roads Making Good
by using

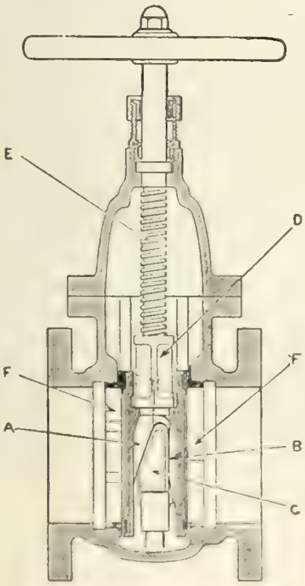
Dundas Stone

Best by Test

Canada Crushed Stone Corporation, Limited
DUNDAS, ONTARIO

Toronto Agents:—Rogers Supply Co., Limited, 38 King Street West

Fairbanks Water Works Valves

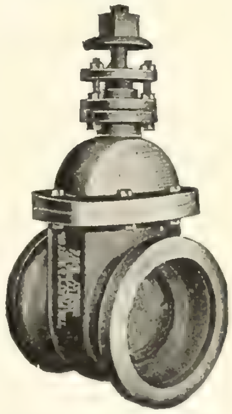


Fairbanks Double Disc Iron Body Gate Valves are particularly adapted to water works installations.

The mechanism permits valves of very staunch and compact design without a clumsy appearance, and offers unique advantages for the renewal of parts with minimum trouble and expense. Ease of operation and absolute freedom from danger of the wedge becoming stuck are valuable features, and the elimination of friction between the bearing surfaces of the wedge faces and seat rings materially increases the durability of these Valves.

The Valve mechanism is a double Gate, simple in construction, and all wearing parts are fully brass mounted.

We are prepared to quote on valves, pipe and fittings for your complete installation and will gladly do so on receipt of blue prints and specifications.



Secure our quotations on Hub End Gate Valves, Hydrants, Valve Boxes, Indicator Posts, Fittings, Pipe, Check Valves.

The Canadian Fairbanks-Morse Co., Limited
Montreal Toronto
Quebec Ottawa
St. John Hamilton
Ft. Wililam
Winnipeg Calgary
Regina Edmonton
Saskatoon Vancouver
Victoria

Canada's Departmental House for Mechanical Goods

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Pittsburgh Valve, Foundry and Construction Company
Sheldons Limited

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Sturtevant Co. of Can. Ltd., B. F.

Steam Turbines
McDougall Caledonian Iron Wks.
Sturtevant Co. of Can. Ltd., B. F.

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Burlington Steel Company
Dominion Iron & Steel Co.
Hopkins & Co., F. H.
Steel & Radiation, Ltd.

Steel
Hopkins & Co., F. H.

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Chicago Bridge & Iron Works
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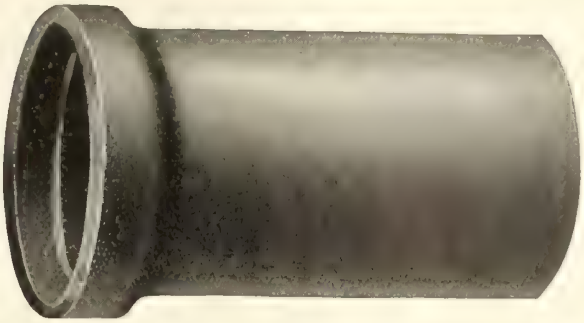

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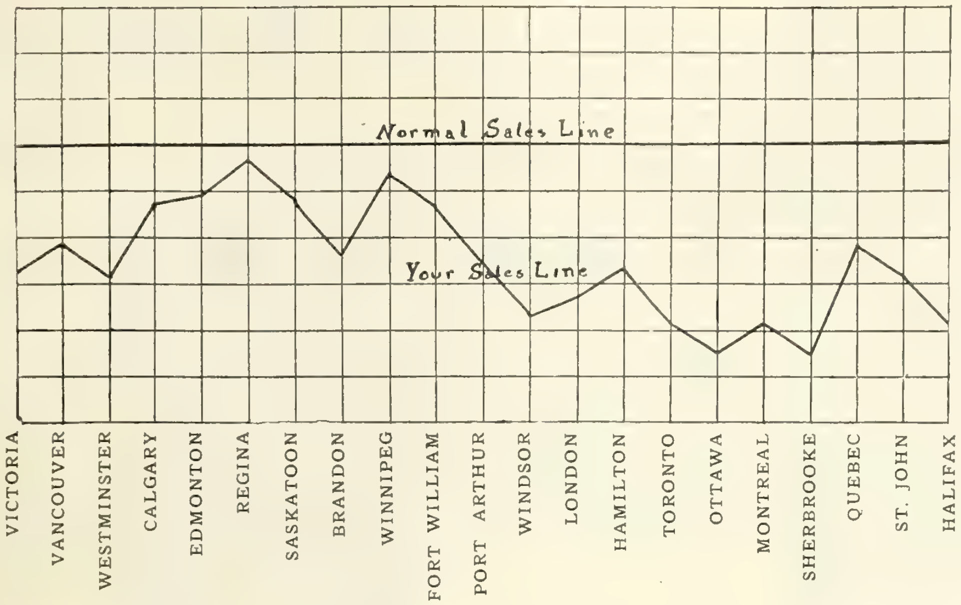

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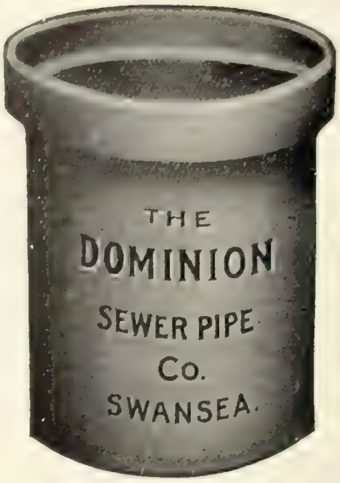

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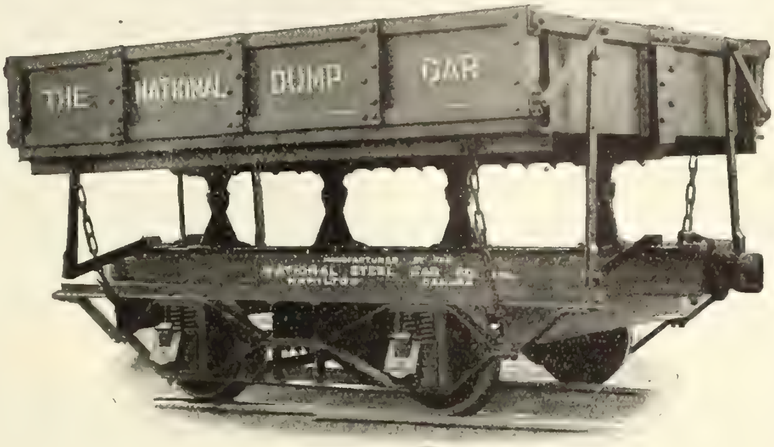

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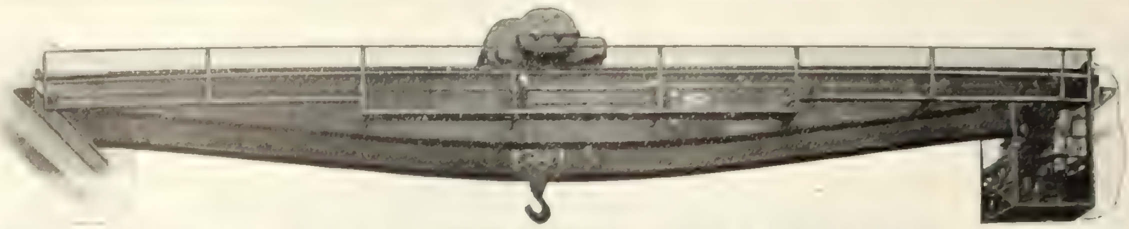

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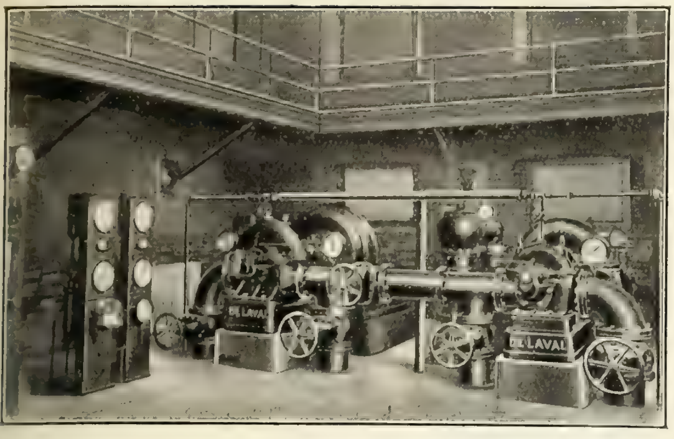

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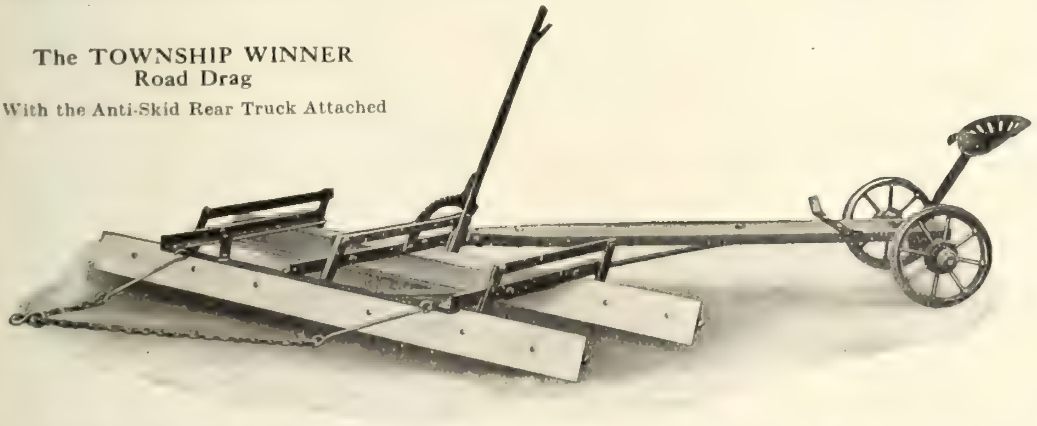

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The Time for Civic Improvements

IN this country the need for doing effective town planning work is apparent. Our towns and cities are now in the process of growing up, and we have every opportunity to profit by the experience of the cities of the old world, who find their cramped streets and slums such a difficult problem. If all Canadian cities were of one mind in the matter we might soon have urban districts that would be a bright example to the rest of the civilized world, but unfortunately many cities that have now attained a considerable size have allowed themselves in their rapid growth to go rather a long way in the wrong direction, and it will be only by taking advantage of the present lull in the rush of business activities that they will be able to place themselves in a strong position as well-built cities.

Ordinarily our organization has been such as to demand constant and speedy growth. There has been little time to consider how this growth might be regulated or guided along reasonable lines. Business blocks have been rushed up without sufficient attention to the fire hazard; real estate values have been inflated, and as a consequence workmen's homes have been crowded together until the districts inhabited by them have come even to have a resemblance to the slums of the larger cities of Europe. Apparently, no one has considered the future, or whether if the conditions are ever to be improved the money will be found to make them.

Now that things are quieter, there is time for reflection. It is true that there is little money to spare for the improvements so sorely needed, but this very fact has opened the eyes of many to the unnecessary expense incurred by letting things slide in the first place to be remedied at some later date. Hard times have drawn attention, also, to the undertaking of municipal improvement work as a means of providing employment, and now that money is less easy to get than formerly city authorities are beginning to realize what the improvements will cost by reason of their having been allowed to remain undone until the city has reached large dimensions. Fortunately this condition is characteristic of only a few of our cities, but their experience cannot be presented too strongly for the benefit of the small towns, and even villages, which we know well may be tremendous cities at no very distant date. Tremendous city or not, however, the need for proper regulation of the growth of a town remains if we are to take full advantage of all the possibilities for healthy conditions provided by the nature of this country. It is not a question of size: the whole matter can be resolved down to a question of the good of every individual. In a large city there are more individuals to be provided for, it is true; but that is just a matter of proportion. The individual should have as healthful surroundings in the large city as in the country village, if we are to realize the ideal of all town planning.

The present period of business depression, which has served to draw our attention to the direction in which our headlong pursuit of wealth was leading us, may also serve to direct our thoughts towards the rectification of some of our errors and to the formulation of a few good resolutions for the future. When the average factory gets through a run of rush work the management generally find it necessary to have a clean-up, and if they are at all inclined to make the most of their opportunities they re-organize their operating system with a view to minimizing the clean up work that will be necessary after another such rush. A similar course should be taken by our municipal authorities: now is the time to recognize deficiencies in the working of systems, and to improve them to meet the requirements of modern social conditions.

This work is being made the easier for the individual municipalities by the organization, by the Dominion and some of the Provincial Governments, of departments to look after the preparation of work in town planning schemes. By the recent Western tour of Mr. Thomas Adams, Town Planning Adviser to the Commission of Conservation at Ottawa, a great deal of interest has been aroused in the cities of the prairies, and it is hoped that this interest will develop into action. If the larger cities will take the lead the smaller ones will follow. It is in the West, too, that town planning projects can be introduced at a most opportune time, for, although the cities have grown up rapidly, they have not been built so solidly wrong, if one may use such a term, as the Eastern cities, which have been built more after the European style. Winnipeg has made a good start: few Canadian cities have such wide main streets in the business districts. For some time there has been a Housing and Town Planning Association, and now there is a Committee of the Industrial Bureau on Town Planning and Civic Betterment to further schemes for improvement in various civic lines. A permanent body known as the Greater Winnipeg Plan Commission has been appointed to take official charge of the work of planning and re-planning.

The Commission is now preparing a plan covering the whole district, so that the city can work to this plan as it develops in the course of time. The area to be covered by the scheme—Greater Winnipeg covering over one hundred square miles—is considerable, but it affords the room for the working out of an undertaking that will make Winnipeg, not only the largest city of the West, but also the best from all points of view. As noted recently in The Contract Record, Mr. Paul Schioler, the City Bridge Engineer, has prepared drawings for the three new bridges which the city intends to build, and in the preparation of these preliminary designs engineer and architect have co-operated to produce bridges suitable in structure and pleasing in appearance.

What Winnipeg is doing is an example of what all our cities and towns should be doing according to their several necessities. Money may be tight, but what we do in connection with town planning to-day will benefit those who come after us. They would have to improve where we have not improved or have let things slide, even as many of the cities of the old world have had to do. If we do our duty in the present there is no reason why the cost should not be spread over a number of years, and the expense will not be so heavy as if the improvements were deferred so long that they became difficult to make. The whole spirit of the necessity of the undertaking of town planning measures at the present time is expressed thus, because it is cheaper to put them into effect to-day, even though money is not so plentiful. Works such as these can be financed without much difficulty so that the burden can be spread over a long period, or at any rate carried along until more prosperous times for disposal.

In addition to its connection with the relief of unemployment, the desirability of undertaking these works now is apparent when we consider what has been the case in the past. We have been too busy growing to care much how we grew. We shall be too busy in the future to pay the necessary attention to the matter unless we organize the whole of the work so that it becomes part of the cities' natural growth. It is useless to make good resolutions and defer their carrying out until the outlook is brighter; they are too likely to be overlooked, as in the past. Now is the time to act, and all our municipalities should back up the Dominion and Provincial Governments in their efforts to make our Canadian cities and towns something for us to proud of. This may entail some sacrifice, but our reward will come in added pleasure in life and the greater prosperity that attends live, well-run cities; and we shall have the additional satisfaction of knowing that we have earned the gratitude of succeeding generations.

Signs of Revival

WHILE only 213 building permits, of a total value of $1,024,115, were issued in the city of Montreal for the month of June, as compared with 549 permits of a value of $1,943,596 for the same month of 1914, it is interesting to note that the figures for June are the best of the year. The previous best month of this year was April, with permits of a value of $973,891. The total figures for the first six months of the year show that 1,161 permits of a value of $3,419,109 have been issued, as against 2,372 permits of a value of $8,521,910 for the same period of 1914. Though the total figures for the half year are behind those for the first half of 1914, it is evident that a considerable revival is under way, and, while Montreal seems to be more favorably placed in this respect, the improvement only reflects the general trend of things throughout the country.

Non-Slip Bitulithic Paving

THE Twelfth Street hill at New Westminster, B. C., now being laid with a bitulithic carpet, will have a non-slip surface. It differs somewhat from the bitulithic paving in use on the flat in several important details, the effect being to afford horses a better foothold than can be had on most paved streets on heavy grades.

The ordinary bitulithic process, in the case of carpeting a sound macadamized road, is as follows: The road is scarified to a depth of three inches, having been first flushed. An inch and a half of new rock is added to the rock loosened by the scarifying process, and the base thus formed is rolled and sprinkled with bitumen in order to form a bond with the 2-inch top, which is spread on in two layers rolled separately. This top is composed of the usual bitulithic mixture of small stone, sand and bitumen, and is put on at a temperature varying from 220 to 250 degrees Fahrenheit, according to the weather. In hot weather, which is better for this work than cold, the mixture need not be so hot. On top of all is spread a squeegee coat of fine stone ¼ to ⅛ inch, rolled in, and the road is finished.

On the hill, however, the process changes when the top has been rolled in. There follows a mineral flush coat of small stone coated with bitumen, rolled in, and the final squeegee coat of ¾ in. stone.

The improvement of Twelfth and Columbia streets is of importance, also, as marking a practice not hitherto employed to any extent in the New Westminster district, viz., that of carpeting macadamized roads. By this method the solid foundation of a good macadamized road is not wasted when it is decided to pave. Already some of the surrounding municipalities have sent representatives to inspect the job, and it is likely that should it bear out the claims of the paving people the method will come to be rather extensively used in the neighborhood.

Beautifying Our Streets*

By Prof. A. A. Stoughton

FOR the last few years we have been so industrious in telling city officials and commissions that city planning does not mean the city beautiful that we have almost persuaded ourselves that this is true. We have been so much concerned with street widths and angles of light and building laws and subsurface structures and areas of courts that the opportunity to discuss beautiful architectural accessories of city planning comes to me as a pleasant surprise. This country is making rapid progress towards fulfilling the scientific requirements of our trade, because so much planning is being done in the light of highly organized study. It is relatively easy to fix the width of streets and not impossible to tell how far apart to put them in a given case; the books will tell how to orient them. There are more and more instances of good street planning in this country, because more new districts are being laid out here than elsewhere; and we have plenty of competent men. But such good work, with all its merit and its scientific accuracy, leaves the man in the street cold. Only a city planner raves over a fine scheme on paper or made "concrete" only in walks and curbs and pavements, because he only can visualize its total effect in beauty, which may never be fully realized. I have in mind a grand avenue, recently constructed in upper New York, 250 feet wide, with all the potentiality of an Avenue des Champs Elysees, which should have become lined with fine residences, but on which the high property values created justified nothing short of tenement houses. It is this total effect in beauty which we are to consider briefly.

City planning, being so comprehensive, cannot consider its duty discharged until its street system is given its proper natural and architectural setting or background, until it is furnished with the necessary fixtures conceived in an artistic spirit, and enriched with objects of sentiment and beauty for the enjoyment of all. What would the streets of most European cities be, fine as their buildings are, lacking the fountains and statues and columns, the commemorative tablets and monuments, which speak in varying language to the passer-by—of patriotism and glory and history; of science and art; of the things of the mind; of local pride; of aspirations and moral values; of humor and gaiety; of religious faith and of life and death—running the gamut of emotions, appealing to every sentiment and stirring thoughts in every cranny of the mind? We think of many towns only in terms of their ornamental features, without which the towns would be uninteresting and bare, like an unfurnished house. More than anything else, this furnishing of the streets with objects making a varied appeal—the gathered mementoes of the past, the artistic heritage of local and race history and achievement—gives a place a personality and an intimate and hospitable character.

From earliest times it has been a most natural custom to decorate the highways and public places with memorials. Our minds run back to the avenues of sphinxes, the obelisks, and the figures of men and animals, symbolizing the gods of Egypt. Among the Greeks and Romans, the votive offerings, the religious figures, the effigies and war memorials and edicules of various kinds, added greatly to the interest of the streets. The Romans were decorators of the public places, their architecture supplying the finest setting possible in the noble colonnades and porticoes, uniting all the separate features into a harmonious piece of decoration. The altars and rostra, the statues of emperors and gods, the columns and triumphal arches, have each a part in the composition. This fine tradition was followed by the Italians of the Gothic period and of the Renaissance, whose spires and campanili and fountains added a different though no less decorative note. The enrichment of the street picture was not by any means peculiar to the sunny southern countries where the open air life is natural. Northern places have held the same custom, and especially in modern times, with expanding resources, they have beautified the setting of their life. In the smaller ones we have a fountain, market cross, a wayside shrine, a figure of the local hero or the glorification of a signal event. In the larger ones we have an Arc de l'Etoile, a Fontaine de l'Observatoire, a Pont Alexandre III., an Albert Memorial, a Thames Embankment, a Scott Memorial, a Sieges Allee, a Kaiser Wilhelm I. Monument, a Victor Emmanuel Monument, a Washington Monument, Grant Monument, and the like, of too many species to mention even the types.

In the logical development of a town the necessaries come first—fixtures for lighting, standards for carrying wires and signboards, mail and fire alarm boxes, receptacles for waste, benches, shelters and waiting stations, drinking fountains for man and beast, kiosks for vending and advertising, public conveniences, entrances for sub-surface structures, bridges and elevated structures. All of these utilities must, of course, be treated decoratively so as to be agreeable in form and to harmonize in scale and character with their surroundings. In many cases the original useful purpose is merged in the decorative, and certain of them—as fountains, for instance—exist for the latter only. In the next class may be put such conveniences as ramps and steps, retaining walls, bridge approaches and waterside constructions generally, city gateways, park enclosures, towers for beacons or bells, clocks and sundials, bandstands and pavilions, which present an even more natural appeal for artistic treatment. Then there are all the resources of nature, the plantation of mass and surface, the green of the tapis vert with the glow of the parterre, and the sparkle and tinkle of water. Then come the purely ornamental features, in which art and sentiment join hands to add the highest touch of grace to the street picture, varying in a wide range between the boulder bearing an inscription and the triumphal arch or the many-figured group. Finally, above all, there is the embellishment of the buildings, private or public, which line the streets or occupy open spaces, and make or mar them. This phase of the subject is outside the scope of this paper, but I may say that if buildings are to enter into the decorative scheme of the streets they should at least be visible. It is sad to think how much of the possible effect of fine buildings is never realized on account of our long, narrow streets and the rigid adherence to the rectangular block. For buildings, as for monuments, a short vista gained by cutting off or turning a street or broadening it into a decorative place is necessary. I come from a place which glories in the possession of several fine avenues 122 feet wide, giving unusual opportunities for architectural effect. One of them is notable as being the longest street in the world. But although running nearly straight for 825 miles, it turns as it crosses another principal avenue, and is faced on the latter by a fine building, which therefore has its full effect. Perhaps I should add in another category those embellishments for which former times give no precedent, which are the most obtrusive and insistent of all, and from which the most enlightened society has so far been unable to protect itself—the advertisements. I will say only that the state which finds a remedy for this outrageous evil, which renders nugatory all beauty in our streets, deserves a reward equal to that of the man who conquers cancer or typhoid.

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* Paper before the recent Town Planning Convention held in Detroit.

There are no rules for designing street features except those applying to other works of art. The book of suggestion is wide open in the aspect of foreign cities and towns. When we turn its pages we find an astonishing variety in the choice of motive, in treatment and in placing. Every problem of treatment and adjustment has its own special conditions and its own best solution by which the object shall be related most agreeably to its purpose and site and surroundings to give it individuality and distinction. To pass about the Grand Boulevards and along the great east-and-west axis of Paris—one of our most common mental promenades—gives a most complete exposition of the subject. We see the monument, isolated or adosse, the column and obelisk, the architectural setting of sculpture, the group and equestrian statue, the fountain and pool, the triumphal arch and the city gate, the decorative avenue leading up to a monument or building, open places of various sorts, the splendid building enhancing and being enhanced by its surroundings, the careful use of the green of nature, the color of flowers and the flow of water, the variety of effects of changing angles of view, the terraces and balustrades and ramps and bridges.

Our cities will scarcely put on the garment of beauty and wear it with an air of ease and accustomedness until our people gain that real culture which shows itself in the appreciation of the fitness of things. Now, even in places where objects of art are set up, we often see glaring and ridiculous contrasts, like a man in full dress with tan shoes or with dirty hands. I have in mind an example of this, where, in one of the most fashionably frequented city squares in America, opposite one of our proudest hotels, there stands an island which was decorated with a bronze lamp, specially designed, provided by an art association. The man who operated a switch near by had made himself comfortable by installing against this lamp a dilapidated rocking chair, which was kept in countenance by a battery of street-cleaners' rubbish cans, brooms, etc., as a permanent furnishing of the spot.

But without a culture and love of beauty for its own sake, and basing our plea on a lower plane, we should accomplish more if we could convince the authorities of the money value of civic art. Just as many foreign products command a high price purely for the element of beauty of design in them, so a beautiful street or square or bridge or building or monument raises the value of real estate in the vicinity, while a city which as a whole is organized on attractive lines draws people and business enterprises to itself, has its fame carried far and wide by every chance visitor, and recoups itself directly and indirectly for the outlay many times over. Beauty as an asset convertible into real estate values and tax returns is recognized by most foreign cities—not yet sufficiently by ours. As soon as our people realize this they will, of course, hasten to invest in public art.

We of this country are fortunate in that few monuments have been inflicted upon our cities, and that other fixtures are not of a very permanent nature. Sculpture has developed as rapidly as architecture in the present generation, and we are now for the first time in a position to memorialize great deeds and events by monuments that future generations will not feel like removing to sequestered depths of the parks. Sunset Cox hailing a trolley car on Fourth Avenue, New York, will hardly have any replicas, to mention but one artless object set in a high place. Despite the absence of art commissions in many places and of competent committees for the erection of memorials, much better work is being done by reason of the general elevation of intelligence which impels committees to seek expert advice in such matters, and because better talent is available. It is far better to leave our streets and parks bare of everything but the necessaries for a long time than to fill them with meretricious ornaments, debasing rather than elevating taste, setting a low standard and pre-empting good sites, as it is practically impossible to dislodge them on the score of bad art once they have dug themselves in. It is well to proceed slowly. All cities and towns, large or small, should be urged to appoint art commissions, or at least to secure competent advisers for special occasions, and all such experts should be encouraged to do their whole duty in maintaining the highest standard in civic art.

The placing of works of art with us is specially difficult on account of the paucity of good sites furnished by the gridiron plan, unmitigated by studied modifications or accidental irregularities. Our street system reduces us to the necessity of placing our ornamental features, other than those in parks, against buildings or near them, or along the edge of parks facing sidewalks, seen as we pass by, not as we approach along a vista. This may be well enough for small and minor objects, if we have enough of them to spare for inconspicuous places, but the wisdom of grouping these things, whether they be few or many, is generally conceded. For larger schemes and formal arrangements the city planner must create sites and provide vistas for the architect and sculptor and the gardener to use. When we see the marvellous impressiveness and dignity of the Place de la Concorde or the Kaiser Wilhelm Platz—the distinction each gives to a whole city—or the fine effect of many smaller squares which may be simply the widening of the highway, artfully shaped and treated, it is strange that our new cities, while they are in the making, should not provide such advantages for the future. As traffic places, or resting spots for pedestrians, or accents in a general effect, or opportunities for formal embellishment, they would be invaluable.

Our planning, or our city growth without plan, has not taken into account the amenities of street life—the chance to pause in the mad rush to get a glimpse of nobler things than trolley cars; to get a new hold on common life by a suggestion of greatness from a monument or of grace from an object of art; to get the uplifting effect of a noble colonnade or tower seen at the end of a vista, or to get a refreshment of mind from the greenness of ordered trees or sward. It has sought only to furnish the greatest number of rectangular blocks. It is time for a new idea to replace this one. The city planner and the monumentalist must co-operate in creating sites capable of a decorative setting and of furnishing them suitably as time goes on as places for the display of the city's sentiments and ideals and taste and for the elevation and distinction of its life. Our inspiration is in the fountain of art; our copybook is the achievement of the past; our teacher, the artistic instinct of the ages.

The Correction of Common Deficiencies in Public Works Reports

A study of the public works reports of different cities discloses a wide variety of treatment and make-up, from the bulky volume with more than a thousand pages to a collection of tables that require a cipher code for their interpretation. It is evident that one or the other or both of these presentations must be wrong. They indicate a lack of conception of the purpose of a public works report.

To be successful it is evident that the purpose of a report—to give citizens information as to the expenditure of public money for public works—must be kept clearly in mind. If the citizen body were composed of those having but a single interest, or if all could be interested in a similar manner, the preparation of such a report would be simplified. But a diversity of interests must be recognized, and the information presented so as to satisfy different requirements, for it is clear that if the manner of presenting the information is such that it cannot be understood by the audience to whom it is addressed the report will fail of its chief purpose. It is therefore necessary, first, to analyze the various requirements of the readers of public works reports.

It will be admitted that these requirements are dependent upon the character of the audience to be addressed. In general the citizen body comprising the audience of a public works report may be divided into three main classes. In the first class are those citizens who have an interest in the activities of their community but who wish for only general information. This class constitutes numerically by far the largest portion of the audience. The second class is composed of citizens interested in a more detailed financial study of the city's activities, such as administrative officials, members of civic organizations, and a few others who would study a report closely. The third class, interested in technical matters, is made up chiefly of engineers within the city and engineers in other cities.

Public works reports in the past have, in general, recognized this division of interest, but seldom has any public works report been compiled with these three distinctions clearly in mind. The result has been that some reports are especially good in a general way, giving matters of general interest but lacking details that are of value to the student of municipal affairs. Other reports give only a mass of statistical detail that has little meaning and less interest to the average reader.

Creating Interest Through the Press

It will be recognized that a most important function of a report is to command as much general interest among the citizen body as possible. Usually the reports, necessarily limited in number, will reach the hands of but few, and if the contact of the citizens with the report were the only means for them to gain information little would be known as to the activities of the city. The channel through which information must come is the newspapers. If, therefore, the information for the general reader is to be in proper shape, a public works report should contain a clear, concise, general review, free from technical language and confusing detail, occupying space not to exceed three or four newspaper columns. Suitable headings and subheadings should be used throughout the report.

This portion of the report should constitute the opening chapter, presumably written by the administrative official in charge of the public works of the city. Information prepared in this manner would then be available in convenient form to be excerpted bodily by newspapers and thus relieve newspaper men of the necessity of reviewing the whole report. In doing this there is a possibility of missing essential features and dwelling at length on unimportant details, for it must be assumed that the head of a public works department must know the relative importance of the activities of his work better than any one else.

Aside from a general review of the entire public works of a city, the report of each bureau, in turn, should have an opening chapter outlining the activities of the particular bureau but entering somewhat more into detail than would be practicable in the general outline, at the same time being free from technical language and confusing tabular matter. Thus it would be possible, aside from a general story of the public works department as a whole, to obtain special stories of each division or bureau of the department.

To compile these portions of the report will require more care and judgment than any other part if the relative importance of the various activities is to be presented to the public so that a true perspective of the whole may be had. At times, with public interest centred on some special work, it will be necessary to describe such a feature in greater detail and length than would ordinarily be required. Again, the necessity of certain improvements which are foreseen by the officials and not realized by the public in general may require special emphasis.

The information desired by the second and third classes of readers, as previously outlined, will necessarily overlap, and it would be impracticable to divide a public works report or portions of the report into two divisions for the primary purpose of supplying separately for each of these classes the information they would require. It will be sufficient in compiling the report that the information these readers seek be presented in logical sequence and as fully as possible.

A tabular arrangement of facts and statistical data should be employed, but each table should state clearly just what it is and make unnecessary a study of the text to explain it. Statistics of expenditures and quantities of work done and costs of work are useful only from a comparative standpoint, so that tables showing only the results for a single year are of little value. Such tables should give data extending over a period of years, and thus make a comparison possible.

Diagrams frequently give the reader a better comprehension of certain facts than can be done by tables, and should be freely used; but, as with the tables, each diagram should be lettered so that with its title its meaning is self-contained.

Typographical Appearance

The readability of a report depends in no small degree on its typographical appearance. The casual reader often avoids the perusal of a report because of its uninteresting appearance. The use of fine type, closely leaded, no suggestive headlines to break up the solid mass of text, few or no cuts to attract the eye, all combine to produce such an effect.

A report, to be readable, should be in clear, good-sized type on a convenient sized page. Frequent headings in larger sized type should be used, while chapter headings would be distinguished by still larger and bolder faced type. It is recommended that the body of the report should be of clear-faced, ten-point, Roman type, and well spaced, averaging about five and one-half lines of print to the inch. The size of forms or printed portion of a page should be 4 to 4½ ins. in width and 7 ins. high. There should be left a margin of not less than ¾ in. on all sides, while a 1-in. margin is better.

Cuts, to be of value, should be clear, made from good photographs, printed on highly calendered paper and of sufficiently fine line so that detail will not be lost. Where paper of a good quality is used for the cuts the screens used in the photo-engraving work should have at least 133 lines and may have 150 lines to the inch. In either case ink of good quality is necessary. Full size page cuts will be found far more satisfactory than reduced sizes crowded two or three on a page. Where cuts are used they should be selected to bring out clearly the point desired so that one may look at the picture, read its title, and get the meaning without necessarily referring to the text. In some classes of work it is well to arrange a series of cuts that will tell the complete story of a process or construction, as the case may be.

Reproduction of Diagrams

Diagrams, to be useful, must be easily readable. As a rule, diagrams are reduced from larger drawings, which will not stand much reduction because the usual lettering upon them, when reduced, will be too small to be read clearly. Generally it is desirable to redraw diagrams that are to be reduced, exaggerating the lettering so that when reduced it may still be of a size that will be read easily. Bolder lines should be used and conventional detail exaggerated so that there may be no mass of lines which will print with a muddy effect when reduced.

Inserts for tables should be avoided where possible; they spoil the appearance of a report, are disagreeable to use, and generally become torn and detached from the report itself. However, their use is sometimes imperative, and where necessary care should be taken that all the inserts are placed in the report to face the same way. For those tables that must be compared with the text it is desirable that, when unfolded, there should be a blank strip left at the margin sufficiently wide that the printed table may appear to one side entirely clear of the page. This, perhaps, applies more to tables that would appear in textbooks than to most tabular statements that would be found in a public works report. Tables may be printed in much finer type than the body of the text, the size of the type being determined by the extent of the table. It is not advisable, however, to use less than six-point type.

Appendices may be set up closely leaded in eight or even six-point type. Six-point type with lines spaced with two points of lead will be found more easily read than eight-point type not leaded.

Few care to keep in a library a paper-bound book. If, therefore, the contents of public works reports are worth preserving it is necessary that they be put in such shape as to invite their retention on book-shelves in private or public libraries. At least a portion of the number of reports issued should be bound in reasonably durable manner. When it is possible, volumes exceeding 600 pages should be avoided. Where the mass of material that must be presented makes larger volumes necessary, it had better be divided and issued in separate, smaller volumes.

Why Publish Technical Information?

The question may be raised by many, "Why should a public works report contain information other than that which interests the general public?" Why, for instance, should technical information, understood and available to only a comparatively few individuals, be prepared and printed at public expense? The answer to this criticism is that progress is constantly being made in municipal engineering work. Conditions change that require different methods of treatment, new processes are evolved and new materials come into use. Some of these methods and materials are more successful than others, and if the records of successes and failures were to be buried in the archives of the various departments, not only would such information, of utmost value to each city, be practically unavailable, but also the experience of all cities would be rendered useless to their neighbors. When the extremely small expense incurred in printing such information is compared with the inestimable value to be gained by every city's officials, there should be no hesistancy on the part of any city to publish in full its experience in all lines of public work.

The limits of this article will not permit a discussion of a detailed outline for each portion of a report on public works or the make-up of the tables to be presented, but enough has been said to indicate the main purpose around which the outline should be arranged and for which the report should be prepared.

The foregoing hints were given in an article in the Engineering Record by A. N. Johnson, of the Bureau of Municipal Research, New York City.

Elevator, boiler and flywheel accident statistics are regularly collected by the Fidelity & Casualty Co., of New York City. The figures for the United States and Canada for February and March, 1915, show 96 elevator accidents, only 13 of which were due to falling lifts. Only one person was killed and 14 injured by the falling elevators, while in the 83 shaft and door accidents 39 people were killed and 45 were injured. Practically all these last casualties could have been prevented by safety gates and interlocked shaft doors.

Wood Block Paving in the West

By S. B. Bennett*

THE use of wood blocks as a means of obtaining a permanent paving has been in vogue both in Europe and the United States for nearly a century, and has met with praise or with ridicule according to the results that have been obtained. In some cases wood block pavements have proved a great success; in others they have been condemned as most unsatisfactory. If careful inquiry is made into the real cause of the commendations or complaints, it will frequently be found that they have their origin in the suitability or otherwise of the materials and foundations obtained.

Some of the most important thoroughfares in European cities have been paved with wood blocks because such pavements have proved to be sanitary, silent, and able to carry heavy traffic.

Of recent years, owing to our highways having come to be used as a means of distributing heavy loads which previously were carried on permanent railway tracks, much more attention has been given to the materials and workmanship for road construction. The introduction of the steam wagon and heavy auto truck demands that even more care be exercised in this class of work.

Formerly wood blocks placed on a wooden base were thought to be satisfactory; little attention was given to the sub-grade or the foundation on which the wood pavement was to be laid, and any kind of soft wood was looked upon as a suitable material. Later on hard woods, such as the Jarrah and Karri of New Zealand and Australia, were put on the market, but it is owing to the introduction of creosote that wood blocks have come to be regarded as a first-class form of pavement. Creosote was used in very small quantities at first, but with further experiment and research it has been found that the wood blocks can be impregnated with large quantities of creosote, much to the advantage and lasting qualities of the pavement. If the temperature and pressure to which the blocks are subjected is not too great, they can be impregnated with creosote up to fifty or sixty pounds to a cubic foot. This amount, however, is considered excessive for paving blocks.

Preparing cushion for blocks.

During the summer of 1914 the Municipal Council of South Vancouver paved Main Street from 16th Avenue to 51st Avenue—a stretch of road two miles long and 54 feet wide—with wood blocks cut, prepared and laid by the Dominion Creosoting Company, a local firm with works situated on the banks of the Fraser River. The contract specified a 4-inch wood block saturated with 10 lbs. of creosote to the cubic foot, laid on a 6-inch concrete base, with a 1-inch cement and sand cushion between the concrete and the wood blocks, together with all necessary curbs, surface drains and catch basins. The pavement is guaranteed for fifteen years. This is looked upon as a great local achievement, for it has been made from B. C. fir, B. C. cement and B. C. creosote manufactured in a British Columbia factory, and dedicated to British Columbians of the present and future generations. It is one of the largest permanent pavement works undertaken in British Columbia, and two hundred and fifty men were employed on it for forty weeks.

Laying blocks between electric railway tracks.

The greatest difficulty was met with in the third section, from 34th to 45th Avenues, where the roadbed passes through what is generally accepted as an old beaver pond, swamp or muskeg. Various trial holes were put down in this section, and it was found that at a depth of from five to ten feet a solid foundation was obtainable. It was absolutely useless to think of putting a concrete bed on such a mass of soft earth, and consequently the whole of this bog earth had to be dug out. To carry out this work two steam shovels and forty teams were kept working steadily for several weeks. When the fill was completed and the roadbed had been well water-tamped and rolled the concrete, of 1:2:4 mix, was poured to a depth of six inches. When the concrete was set a sand cushion known as 3 to 1 mix was placed and sprinkled carefully, and on this the creosoted wood blocks were laid.

The roadway has been built by what is known as "lath construction." This leaves a space of from one-quarter to three-eighths of an inch between the blocks, which is then filled up with hot gravel, and while the gravel is hot a preparation of bitumen at a temperature of 300 degrees Fahrenheit is poured over the surface. After this mixture had percolated into the joints a further squeegee coat was poured over the blocks to fill up all the interstices. Next a thin coating of fine gravel was thrown over the surface and in a few hours the street was opened for traffic.

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Cement Testing

Throughout the whole of the contract samples were taken from each consignment brought on to the works, and the following tests were carried out:—(1) fineness; (2) specific gravity; (3) normal consistency; (4) time of set; (5) constancy of volume (normal and accelerated). The briquettes were all cured as nearly as possible under normal conditions in the laboratory, and the "personal equation," for all practical purposes, can be considered constant.

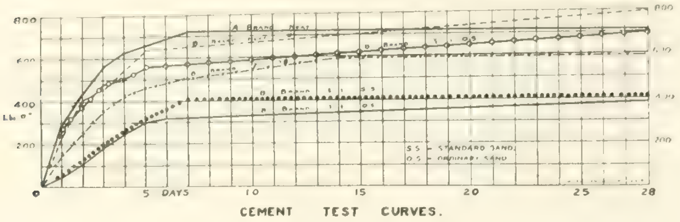
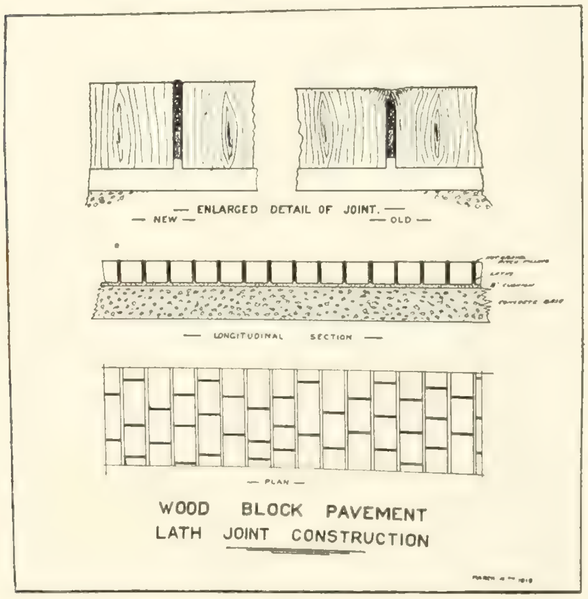


Diagram showing result of cement tests.

Apart from the tests of neat cement, and with standard sand (Ottawa Silica Company), tests were made of cement and the actual materials used on the works, as follows:—

Curb Mix.—3:1, 2:1, 1½:1, and cushion—3:1. Results are tabulated for comparison with that of standard Ottawa sand.

Tensile Strain.—The briquettes for these tests were cured uniformly in a moist chamber, and a Fairbanks testing machine was used. The averages tabulated show the result of a series of twenty-one tests for each reading for neat cement, and ten and five readings respectively for 3:1 and 1½:1 mixes.



Track construction with wood block paving.

Fineness.—The tests for fineness were averaged from 25 samples taken from bulk, with results as stated below:—

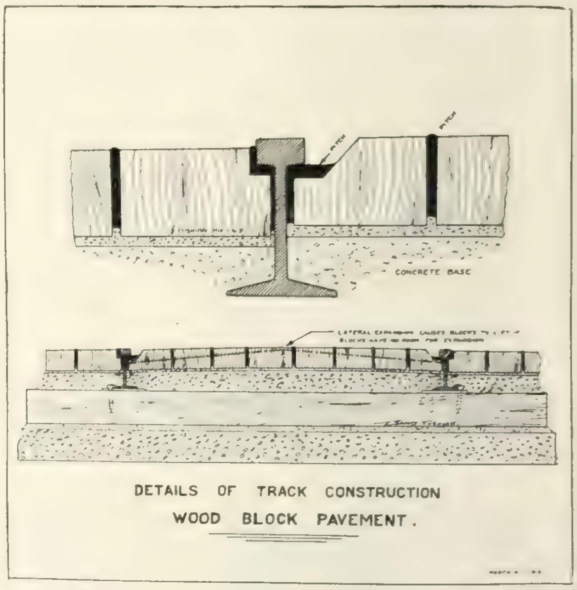
No. 100 Standard seive 2.1 per cent. residue.
No. 200 Standard seive 20.5 per cent. residue.

Tests of the above were made with 50-gramme samples, heated to 100 degrees Centigrade. The curve as illustrated is very interesting, showing the results of two different brands during a period of from one to twenty-eight days.

Wood Blocks

The wood blocks were rigidly inspected at the works during treatment, and notes were taken of the time under treatment, the contents of the charge and the amount of oil absorbed and the temperature and pressure maintained.

With respect to oil penetration, the standard can only be regarded as an average one on account of the wide difference in the density of the fir wood. It was found, however, on examination of the various exhibits, that the blocks after treatment showing an average penetration of from 1 to 1½ inches had shown at the end of sixty days a thorough penetration, and often a well-saturated block. Samples from bulk deliveries on the work from the commencement to the finish of the work were taken regularly and were tabulated carefully, and the results bear out the correctness of these remarks, and also help to prove the fallacy of assuming that, although a block delivered directly after treatment may show a penetration of even less than an inch, it is of necessity a poor block.



Details of paving.

The mode of lath construction of wood block pavement is shown in detail in the diagram herewith. The lath joint gives plenty of room for expansion, besides binding the blocks together, as the mortar joins the bricks together in the building of a wall.

Track Construction.—The class of paving to adopt between the rails in any track construction is one of the most debatable subjects in the design of good roads. As will be seen from the drawing, special gauge blocks were used, and over the fish plates long blocks of specially hard wood were used, the blocks being slightly longer than the fish plates and purposely drilled and bevelled for receiving the nuts which jointed the rails. This was considered one of the special features on this class of work as carried out in South Vancouver.

Pumps for City Water-Works*

By J. E. Craig†

THE selection of pumping machinery for modern plants has afforded the opportunity for the making of many mistakes in judging the real value of the equipment adopted. City authorities are apt to consider that they can determine the value of a pump as well as an engineer, and ignore his recommendations, while often enough the engineer designing water-works plants has not judged aright of the worth of pumping equipment for peculiar conditions.

For pumping service in villages and small towns where the regular domestic supply is from an elevated tank the demand is for a pump to fill the tank at intervals and to furnish direct pressure for fire-fighting purposes. If there is available a reliable source of cheap electric power, motor-driven turbine pumps or triplex plunger pumps are desirable—the latter driven through gears by electric motors. If such electric power is not available, triplex plunger pumps driven by gasoline or kerosene engines should be given careful consideration. These machines are highly desirable for intermittent service, as they deliver their full output at once when started, instead of requiring such time as is necessary to raise steam in a boiler for a steam-driven pump. In addition to the great loss of heat from the boiler while the pump is not in actual operation, the inefficiency of all small direct acting steam pumps almost eliminates this type, except when operated in connection with an electric lighting system which requires that steam be kept up most of the time, at any rate.

In considering the service for towns which use from 1,000,000 gals. to 5,000,000 gals. a day there is a broader field for careful consideration as to the actual conditions to be met. When the supply is taken from a river and first delivered to filter beds there is nothing better than the turbine pump for this service, as a low and practically constant head is to be operated against. The turbine pump may be driven either by an electric motor or steam engine, as the local conditions demand. Where the source of supply is wells in which the water does not rise to the surface the engineer may consider several methods. One is the direct acting deep well pump with the steam cylinder at the surface and the water piston near the elevation of the source of water, actuated through a long vertical piston rod. One of the best examples of this system is at Memphis, Tenn. The Memphis supply is interesting because such a large city is supplied from a great many wells scattered for a considerable distance and flowing into a masonry tunnel which is nearly 100 ft. below the surface of the ground and which discharges by gravity into a sump at the pumping station. The steam cylinders of the vertical pumping engines are in the engine room at the surface of the ground, while the water cylinders are far below near the surface of the water. These engines have given excellent service.

Small pumps of the usual deep well type are liable to give considerable trouble with the water piston and valves far below the surface of the floor and where they cannot be inspected, as the ordinary deep well pump has its piston rod and water cylinder in a well usually less than 1 ft. in diameter. The pumps at Memphis are in a sump large enough to give ample access even at the bottom for attention and repairs to the water cylinders.

In some parts of the country where the source of ground water is not more than 30 or 40 feet below the surface the ordinary duplex steam pressure pumps are put in a sump, far enough below the surface so that water can be drawn from the natural source with a suction lift of not more than 15 ft. This arrangement, which subjects the pumps to possible submergence if the level of the ground water should rise, and from the usual dampness and inaccessibility of such places, is in small favor. In the rice fields of Louisiana and Texas a submerged vertical turbine pump in the bottom of the well, driven through a vertical shaft either with a belt or electric motor, has found considerable favor.

For a reliable method of raising water from a considerable depth probably there is nothing better than compressed air. The air lift leaves much to be desired in the matter of total efficiency, but its reliability of operation and durability offset this objection. The entire engine is in the pumping station. One compressor can raise water from one well or many, and they may be scattered widely. When the available funds will provide a compressor with Corliss valve, steam cylinders, and condensors, and two stage compression, if the required pressure warrants this, very satisfactory operating efficiency is obtained.

In the choice of pumping engines for the smaller cities, which require between 1,000,000 and 5,000,000 gallons daily, there is a slightly wider range of equipment from which to make a choice to meet the conditions of the individual installation. In this class of pumping station 24-hour attention is usual. Most such cities operate an electric lighting system in connection with the pumping station, which requires that boilers be kept in operation constantly. Under this condition the choice lies between several arrangements with steam as the motive power. When the engine operating the generators are of high efficiency, ample capacity, and in duplicate, electric motor-driven pumps give excellent total efficiency. The higher steam efficiency obtainable from the steam engine often more than balances the loss in electrical equipment. Either turbine pumps, direct connected to electric motors, or triplex plunger pumps, motor-driven through gears, are available.

It is usually demanded of pumping engines that they deliver the normal domestic consumption, against about 50 lbs. to the square inch, for more than 95 per cent. of the time in operation, and yet be capable of furnishing this same output and considerably more for fire streams, at 125 lbs. to the square inch, or more. This condition means the engine must operate 95 per cent. of the time, at about 40 per cent. load, or at times of fire at more than 100 per cent. over-load, depending on whether the engine is designed for its rated service at domestic or at fire pressure. To meet these requirements two turbine pumps can be operated in series for fire pressure and either operated singly for domestic service.

To have duplicate equipment, either set of which is capable of meeting any reasonable daily demand for both domestic and fire service, is absolutely essential for a first-class water-works pumping station. To meet this condition will require much idle equipment, or operation at small load factor, with turbine pumps. Triplex plunger pumps, motor-driven, give good efficiency under domestic service pressure, and will deliver the same volume at double the pressure when required. They are reliable and worthy of careful consideration in this connection. For service of this character duplex direct acting, tandem compound, or triple expansion, condensing pumping engines are probably the most used. Under favorable operating conditions a duty of 70,000,000 ft.-lbs. per 1,000 lbs. of steam may be approached. In the smaller stations of this class one more expensive compound engine may be installed, which will do most of the work with reasonable efficiency, and one Standard Underwriters' Steam Fire Pump, which will serve to aid in giving fire service, and can furnish domestic supply also when the more efficient engine must be stopped for repairs.

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* From The Cornell Civil Engineer.

† Engineer of the Board of Port Commissioners, Jacksonville, Fla.

In many of the stations delivering 5,000,000 gals. a day or more vast sums of money are wasted, either through the operation of equipment unsuited to the conditions, or equipment that would be inefficient under any conditions. Here it becomes possible to make interesting comparisons between present and final economy. Large pumping engines may be obtained that will give a very high operating efficiency. Some in daily operation are giving a duty of about 200,000,000 ft.-lbs. per 1,000 lbs. of steam. These engines, of course, represent considerable capital, and the problem before the engineers is to determine how large an investment the proposition will warrant. It is possible to purchase costly, high-duty engines and operate them under such conditions that the interest on the first cost of the engine is more than the saving effected by their higher efficiency in operation.

For the smaller stations in this class the horizontal cross compound crank and fly-wheel type of condensing engine offers a satisfactory total efficiency; its first cost is much less than the vertical triple expansion, crank and fly-wheel type, and a duty of 125,000,000 to 150,000,000 ft.-lbs. can be obtained.

In the larger stations, using only engines of a daily capacity of 12,000,000 gals. or more, every factor should be considered before any but the vertical triple expansion type of engine is chosen, if the necessary money can be secured to install the more costly type. Data should be obtained as to the actual daily probable output during the term of service of the engine and the cost and efficiency of the two general types of machines. In the larger pumping stations, when the city also owns its electric lighting system, there is a possibility of securing considerable saving in the joint operation of the two stations by having a turbine pump designed to deliver at best efficiency the average domestic consumption so that it will be running practically constantly; this pump to be driven by a synchronous motor so designed and operated as to improve the power factor on the electric circuit.

Foreign Development of Floating Concrete Caissons[*]

By Harrison S. Taft, assisted by O. D. Jones

APPARENTLY, in overlooking the opportunity and advantages to be derived in using floating concrete caissons in port and other subaqueous work, the harbor development engineers of this continent have perhaps been neglecting a type of structure that has been widely and successfully used by foreign port engineers since 1905. It is possible that the small amount of attention which has been given to an extensive development of our shipping ports during past years has not called for any special treatment of the subject. It is also possible that past failures in the use of cement under salt water conditions have prejudiced conservative concrete engineers against the use of such a material when in contact with sea water. Then, again, certain legal considerations may have operated against the development of floating concrete caissons in hydraulic engineering in this country.

Whatever have been the real reasons for the antipathy of the American engineer toward taking up the development of floating concrete caissons, in view of the vast sums that are now being spent in making our harbors and shipping facilities equal to the most modern of foreign ports it would seem that such a type of structure might be made to play an important part in such work. Not only can they be built in the dry and thus become thoroughly cured before coming into contact with the sea water (a most essential feature in the use of cement subjected to salt water action), but their economy over old time methods of such uses of concrete is marked.

In order to learn of the real value and worth of such a type of structure in future development of our ports it is perhaps fitting to review what other nations have been doing in the use of floating concrete structures, especial emphasis being placed upon floating concrete caissons in this discussion. While such a review may not determine the origin of the art, it does seem apparent that the actual practice of using floating concrete caissons has been carried out simultaneously in Europe and America. Though United States patent papers covering "Reinforced Concrete Caissons for Use in Hydraulics" were granted to Col. W. V. Judson, Corps of Engineers, U. S. Army, in 1901 and 1909, the records of foreign technical papers, etc., indicate that a number of years before Colonel Judson made a practical application of his idea floating iron caissons, constructed partly of concrete, were used by foreign engineers in the construction of their breakwaters and other subaqueous structures, thus perhaps opening up the question as to who was the real originator of such a mode of construction, the use of reinforced concrete having been but a detail improvement over and above the type hitherto used.

Floating Iron Caissons

Since the idea of using floating concrete caissons seems to have been a step in advance from the use of iron caissons, it is fitting to make note of a few undertakings with such a type of structure, especially those structures which it has been plainly stated led to the adoption of full concrete structures in the subsequent undertakings. For, as will be soon noted, the successful use of floating iron caissons in the construction of the west jetty at Port of Bilbao, Spain, during 1895-1902 led to the adoption of full concrete caissons in the construction of a breakwater and sea-wall at Barcelona, Spain, in 1905.

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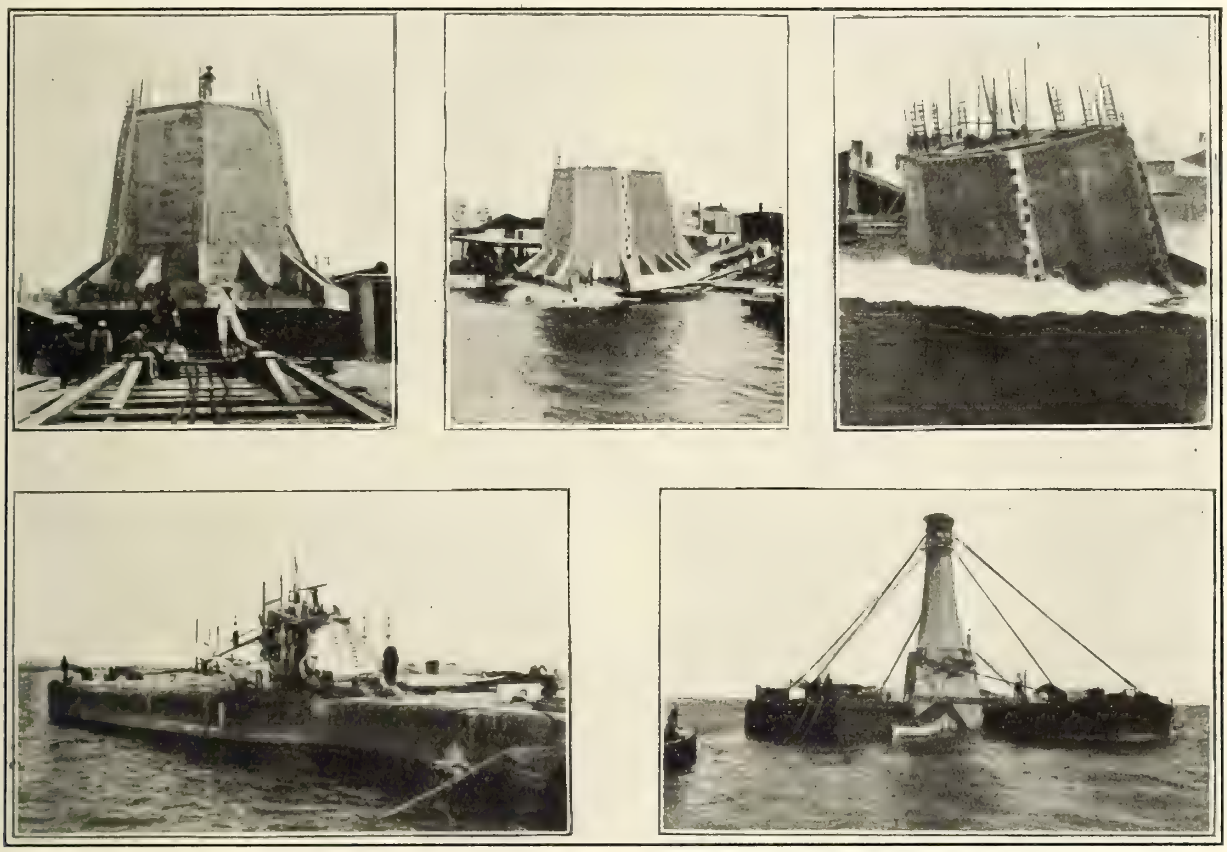
[*] Part of an article printed in the March-April issue of Professional Memoirs, Washington, D.C., to which paper we are indebted for permission to reprint the article and for the loan of the illustrations. The part of the article covering the use of concrete caissons in America appeared in our issue of June 30.

The first of the iron caissons used at Bilbao was constructed in 1895, the successful results obtained with this pioneer structure resulting in the same system being used throughout the entire work. Each of these caissons was approximately 42½ feet long, 23 feet wide, and 23 feet high. After being built on the shores of the port they were put afloat and ballasted with concrete to a depth of 5 feet from the bottom. They were then towed to and sunk into position upon a rubble foundation by means of water ballast. Twelve premoulded concrete blocks, each about 13 by 9 by 8 feet, containing 40 cubic yards of concrete (equal to about 80 tons), were immediately placed in each caisson in order to obtain sufficient stability against wave action in the shortest space of time—a much quicker operation than if concrete had been used. The voids between the sides of the iron caissons and the blocks were then filled with grout. On top of the substructure thus prepared was built a superstructure in the form of a sea-wall. The time of placing and filling a caisson was about thirty-one hours. This undertaking appears to have been the pioneer in the use of such a mode of construction.



Lighthouse caisson and tower, Alexandria, Egypt, showing (1) Caisson on slip; (2 and 3) Launching, first and second stages; (4) Completion of superstructure; (5) Steadying of floating caisson between two lighters, front view.

At a still later date (previous to 1900) the same mode of construction was used at Zeebrugge in the North Sea, with the exception that the iron caissons rested directly upon the bottom of the sea, and not on a rubble fill. The iron caissons in this undertaking were 82 feet long, 29½ feet wide, 28½ feet high, and weighed about 4,500 tons when filled with concrete. The caissons consisted of an iron frame built of angles and tie members, the whole covered with a steel plate so as to form a concrete form, as it were, of the proper shape, the concrete being poured into the form thus built, the metal form becoming a part of the permanent structure. The thickness of the sides of the complete structure was 3 feet at the base and 1 foot at the top. The caissons were floated to position and sunk, and then filled with concrete.

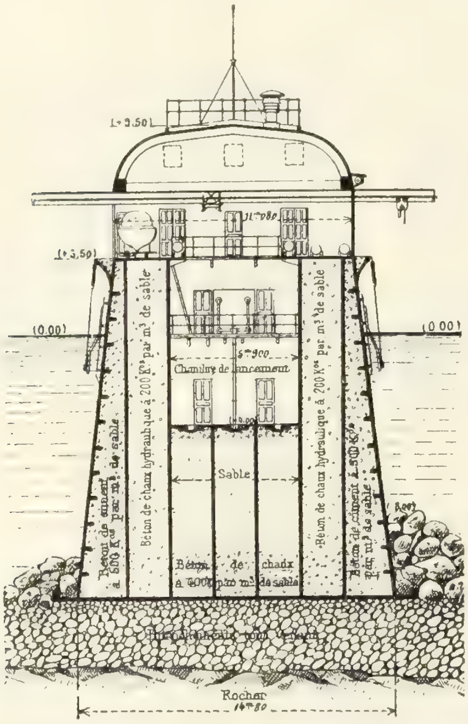
Though the authors found reference to "The launching of concrete and masonry blocks in repairing jetties in 1901," they were unable to obtain detail information concerning the work. From the title it would appear that some type of floating concrete caisson might have been used. Still, from the few cases cited, it is self-evident that floating concrete caissons were, as already stated, simply a step in advance of floating iron concrete caissons—a step that would follow naturally with a wider development of the uses of concrete.

Though at first the difficulties of launching a concrete structure void of any reinforcement would seem insurmountable, it appears (as will be noted further on) that the uncertainty in respect to the floating capacity of a cellular concrete structure of large size was the prime factor that delayed the use of floating concrete caissons in hydraulic engineering, the launching problem having been solved by the conception, by English engineers, of a lifting-depositing dock.

Spain

Barcelona.—While the conception of using floating reinforced concrete caissons in hydraulic engineering may have originated in America, the first practical use of such a mode of construction seems to have been made in a foreign country—namely, Spain.

As stated by Don Julio Valdes y Hamaran at the International Congress of Navigation held at Milan in 1905, the design adopted for the Barcelona (Spain) breakwater was "derived from the type so successfully used at Port of Bilbao" (Spain). A riprap substructure was first constructed and 80 tons of concrete blocks thrown in at random, "raising the substructure on the outside from about 30 feet below to about 6½ feet above sea level." On the inside was built a wall "composed of monolithic concrete caissons, forming the last word in this sort of work." The space between the concrete caissons and the pell-mell concrete blocks was filled with riprap of large stones, a double tier of concrete guard blocks being set on top of the fill. The quay and shelter wall of the breakwater rest on the monolith caissons. The plans for this structure were approved of in 1903, and the work begun soon afterwards, being in full swing during 1905. From the above it appears that the first use of floating concrete caissons was on the part of Spanish engineers.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Béton de chaux à 300 Kos par m³ de sable
Béton de chaux hydraulique à 200 Kos par m³ de sable
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Transverse section through torpedo testing station near Toulon, France.

As noted in the Proceedings of the International Congress of Navigation, held at St. Petersburgh in 1908, the floating concrete caissons used in Barcelona in 1905 were "not made of armored concrete." They were made "without any kind of strength at their base, in the long walls, or in the intermediate bulkheads, thus avoiding decomposition of the armored concrete and obtaining a maximum economy in first cost by not resorting to expensive material." The caissons were about 46 feet long, 20 feet wide, and 23 feet high. The cement used was "Grippe Cement from Teil." The bottoms of the caissons were made of practically a 1:2:4 mixture, and the walls of a 1:1½:3 mixture. The walls were also given a coating of 1:1½ mortar in order to increase their water-tightness.

From information available it seems that the caissons used at Barcelona were built on a sort of building stage and then put afloat by means of the lifting-depositing dock, spoken of above, and as will be further described in discussing the work at Kobe, Japan. The caissons were given one month of curing before being put afloat, and then moored in the harbor for various periods in smooth water, awaiting a favorable opportunity to set, though no doubt some were set immediately after launching. The time required to manufacture one caisson has been stated to have been eighty-four hours—and the time of towing to their final resting place and the sinking thereupon about three hours. The method used in sinking was by water ballast admitted through valves in the sides of the caissons. It appears that in some cases large sized concrete blocks were used to fill the settled caissons, as in the case of the Bilbao work already spoken of; at other times large sized stones were used, the water pumped out, and a grout fill pumped in to fill the voids.

As is usual in pioneer work, it is perfectly plausible to imagine a variety of schemes having been used in the work, each an improvement upon the other, and all leading to a successful conclusion of the entire undertaking, detailed information upon which is perhaps not readily obtained by the American engineers.

Although the caissons employed in the pioneer usage were of a somewhat small size compared to similar structures used now-a-days, this fact was recognized, for, as Don Hamaran stated in 1905, " . . . . . it is believed that the system would be perfectly applicable with larger dimensions. Furthermore, the net cost per unit would be less, as the use of cement and the cost of transportation of the blocks, which are inversely proportional to the volume of the latter, would be reduced."

Holland

Rotterdam.—The most extensive use of reinforced concrete caissons in harbor development work appears to have been made by the Hollanders, who perhaps are, from necessity, the most famous hydraulic engineers in the world. The first use made by them of such a type of structure was in 1905, in the re-building of a river-wall at Rotterdam that had become badly damaged. In fact, the original wall had for some unknown reasons split in two and been shoved out of line for a distance of some 675 feet—even to the extent of some 5 feet at one point in the wall.

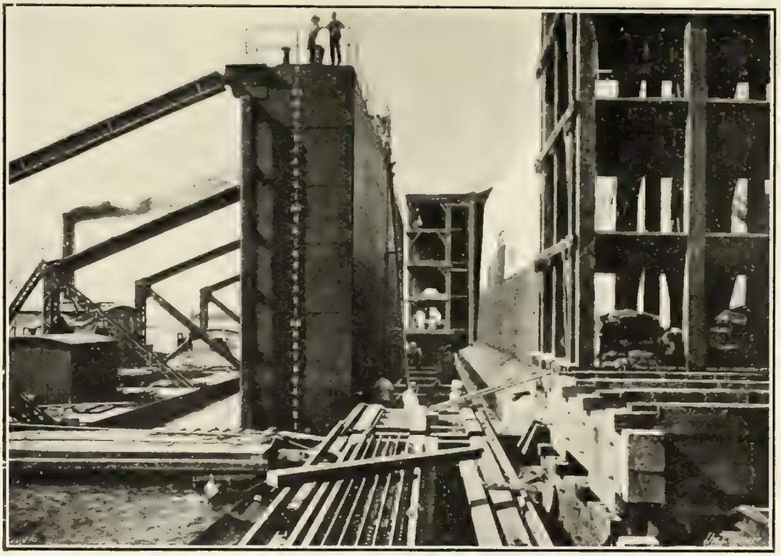
In making the repairs rows of piles were first driven along the face of the old wall and capped with heavy timbers below the water-line. Six reinforced concrete caissons were constructed in a dry dock, given three weeks of curing, and then put afloat like a big barge. After being kept afloat for about two months, the caissons were towed a distance of some three miles to the location of the damaged wall. After being properly located they were sunk to position upon the prepared piling foundation in such a way that two-thirds of the caisson rested upon the base of the old wall and one-third upon the wood piling. The caissons were then built up to the height of the old wall.

The first one of these caissons was about 75 feet long, 18 feet wide, and 4½ feet deep, with partitions about 6 feet apart, thus making a cellular structure of it. The success obtained with this first attempt was marked, and justified the engineers in using the same method of procedure in repairing the rest of the wall, the other five caissons being 120 feet long and 30 feet wide. These caissons were of a 1:2:2 mixture with the outside surface coated with tar.

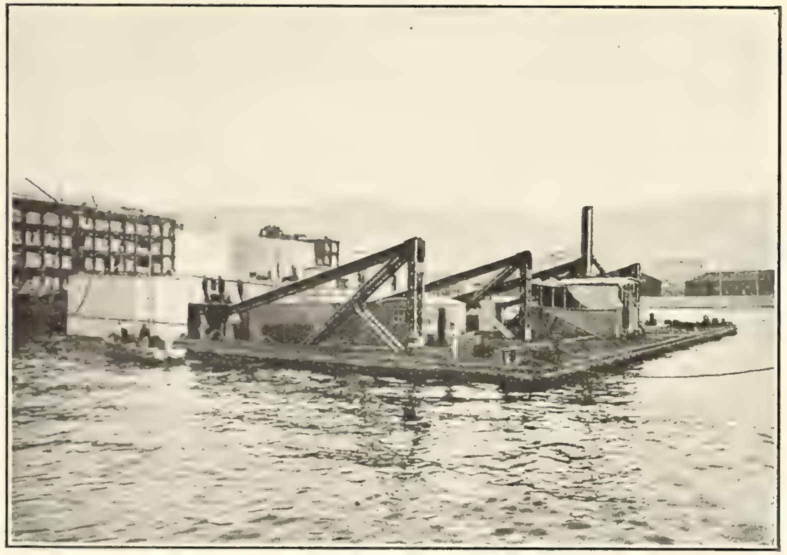
The unqualified success attending the use of floating concrete caissons in making these repairs led the engineers of Rotterdam to build full depth caissons which would rest directly upon the sandy soil without

Building Caissons for the Kobe Harbor Improvements, Japan

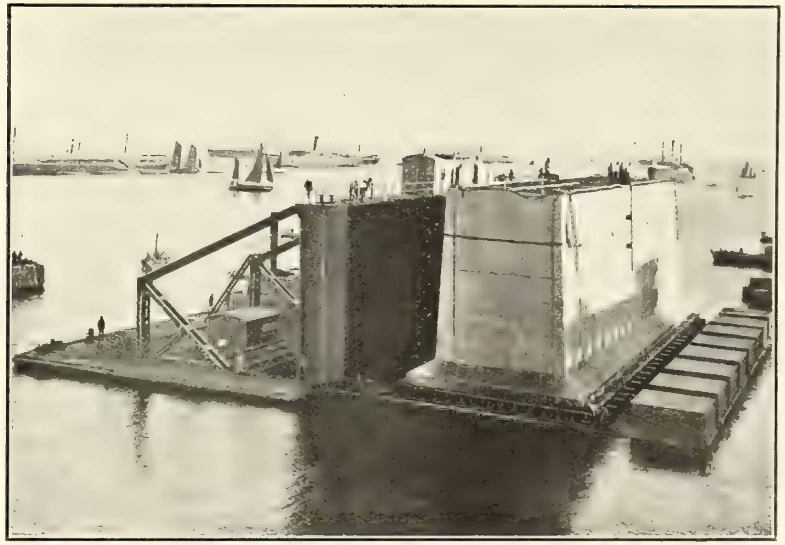
Caisson afloat, towed by a tug.



Depositing dock with its pontoons inserted beneath caisson.



Dock and caisson withdrawn from the building stage.



Dock carrying a caisson on its pontoons.

any sub piling, a type of structure that has become the standard practice for their river walls.

In undertaking the construction of six full depth caissons in building some 615 feet of wall in 1906 the engineers first experimented with two such structures, building them simultaneously, each being 30 feet high. In order to obtain proper stability it was necessary to place ballast in the two caissons before launching. Since the floating draught was more than the depth of water over the dock's sill, it was necessary to use pontoons in floating the concrete caissons.

After being put afloat the caissons were towed to their final resting place in the wall and sunk on to the prepared sandy bottom. The experience with these two caissons led the engineers to consider the feasibility of building the caissons only to such a depth as to guarantee floating stability when first put afloat, their up-building to take place afterwards. These two caissons also led to a more satisfactory design for the following caissons, and proved conclusively that large concrete structures of a cellular construction could be kept afloat for a long time.

The four remaining caissons in this second wall were designed for a length of 120 feet, a depth of 30 feet, and a width of 21 feet, the walls being built with a batter. The main body of these caissons rested upon a heavy concrete slab, built monolithic with it, 29 feet wide, thus forming a shelf, as it were, some 4 feet wide on each side, beyond the sides of the main body of the structure. The ends of each caisson were so built as to form a dovetail joint with its neighbor. The caissons were divided into twenty compartments by means of nine athwart partitions and one longitudinal one.

In constructing these four caissons a pit was dug in the river bank, covered with 9 feet of sand, and a platform made by driving wooden piling into the fill. The caissons were first built to the height of some 17½ feet and then put afloat, having a draught of about 11 feet, with a freeboard of about 6 feet. They were then built up to at total height of 30 feet, corresponding to a draught of 22.5 feet, ballast being inserted to provide the necessary stability. The caissons were then towed to their proper place in the wall and sunk into position upon the prepared bottoms by means of water ballast, the entire work being carried out with great success.

After the sinking operations had been completed, the cells of the caisson were filled with concrete and sand, concrete being used for the front row of cells and sand for the back row. If the front row of compartments had been filled with sand there would have been a danger that it might in some way work out of the said compartments and thus destroy the stability of the whole wall against sliding. As the concrete fill was placed in the dry, the outer walls of the caisson, as well as every other cross wall, had to be designed for a pressure head of 33 feet.

Since the caisson had but 1½ feet of freeboard above low water when sunk into position, and the water rose to 3½ feet above them at high water, it became necessary to place an iron deck over four adjoining compartments—made water-tight by hemp packing—the decking being provided with four hatchways, one to each compartment. The four compartments were then pumped out in such an order and at such a rate as not to create too great a difference in water level, and thereby avoided any excess pressure upon the interior partitions. The two front compartments were then filled with concrete at the same time —the two rear compartments being filled with water to preserve an equal pressure on each side of the longitudinal bulkhead. After the concrete had been completed the two rear compartments were filled with sand dumped into the water in the compartment. The main wharf wall was then erected on top of the completed caisson.

The third attempt with floating concrete caissons at Rotterdam followed soon after the completion of the above six full-depth caissons, the same mode of construction being used as in the preceding case. The wall in this third undertaking was 4,800 feet long. Since it was possible to have under actual process of construction four full-depth caissons at the same time that four other caissons were in the process of setting in the wall, each caisson being 120 feet long, 960 feet of the wall was in the making at one time—a rate not possible with the ordinary modes of building walls.

A still later use of concrete caissons at Rotterdam was shown in 1911, in a further extension of the river-walls. In this case the type and mode of construction used in the building of the 4,800-foot wall was adopted, the caissons being 134 feet 6 inches long, 32 feet 9 inches wide, with a base of 31 feet 10 inches.

Since the Rotterdam engineers have standardized the type of their caissons, it is reasonable to suppose that all future river-wall work done at Rotterdam will be similar to the above described methods, and that said method can be adopted with a guarantee of success by other engineers.

Denmark

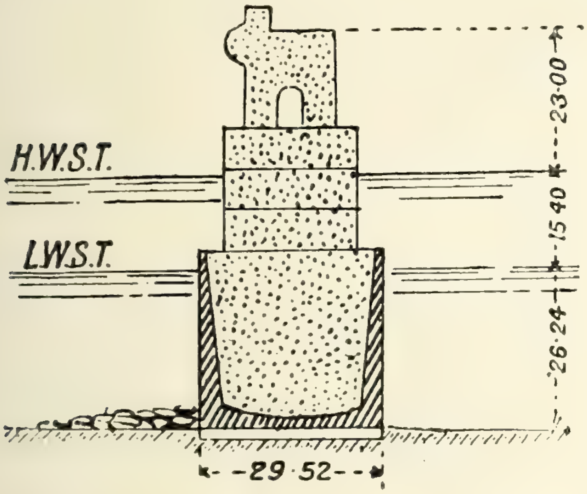
Norre-Sundby.—At this harbor in Denmark floating concrete caissons had to be resorted to in the construction of a dock 725 feet long, on account of the poor soil and the teredo. The methods used were similar to the methods used at Rotterdam, with the exception of the size of the caissons. The Denmark caissons were 32 feet 9½ inches long, 25 feet high, and contained five compartments, there being four athwart partitions and no longitudinal ones. The fill material was of sand. A concrete wall was built along the upper half of the caisson above low water level.

France

Toulon.—The first attempt with floating caissons on the part of the French engineers seems to have been in connection with the construction of a torpedo testing station near Toulon, France, in 1909. The caisson was of a truncated pyramid shape, was built in a drydock, put afloat, and towed to and sunk in its final position. The base of the truncated structure itself was 77 feet long by 48½ feet wide. The platform slab upon which the main structure rests was 77 feet long but 55 feet wide, thus forming a shelf outside the truncated structure of some 3¼ feet along each side. The height of the truncated structure is 51 feet, 11½ feet of which is above the water level, the remaining 39½ feet being submerged. The sides and ends have a tumble-home with a flared-out shelf at their top so as to cause the waves to return on themselves. Thus the top of the structure is but 70 feet long and 36½ feet wide.

The caisson is divided into seventy-seven compartments by means of ten athwart and six longitudinal concrete partition walls, the compartments being filled with a lean concrete and sand ballast to weigh the caisson down. The bottom slab, the outside walls, and the interior partitions are but 6 inches thick, properly reinforced. The base slab is built with a camber of 2 inches transversely. On the top of the caisson is located a superstructure of a design suitable for the purposes of its special uses.

In building the caisson a dry dock was made use of. First the 6-inch slab was poured, then the exterior and interior walls were brought up, the former to their full heights, the latter for a height of but 10 feet. After the caisson had been put afloat, the interior walls were brought up to a height of 37½ feet. A concrete fill was also put in the lower part of each compartment to a depth of 6½ feet, giving a draught of 26½ feet, corresponding to a displacement of 2,800 tons. After being properly protected and internally braced the structure was towed some 22 miles to its final resting place at a speed of about 1½ miles an hour without any difficulty. The caisson was sunk by water ballast to its final resting place on a prepared bottom. The different compartments were then one by one pumped out and filled with a suitable concrete fill. The fill in the compartments next to the shell was of a lean cement concrete carried their entire depth. The next set of compartments had a lean lime concrete fill, also carried their full depth. The interior compartments were filled with sand to the level of the working platform and then covered with a cement floor slab. A rock fill is provided around the outside of the caisson at its base to prevent scouring by wave action.



Jetty, Zeebrugge, Holland.

Paris.—In building a pier for a railroad bridge over the Seine in 1911 four reinforced concrete caissons were first built on the river bank, launched at the end of six weeks of hardening, towed to their final location and then sunk to position. Each caisson was 34½ feet long, 14½ feet wide, and 14 feet high, well reinforced in each direction. The upstream ends were rounded. The walls were 6 inches thick at the bottom, tapering to 5 inches thick at the top. The caissons were built with a temporary wooden base which could be knocked out when the caissons were in their final position for sinking. After being sunk the interior of each caisson was filled with concrete, the fill resting upon 12-inch diameter concrete piles.

Havre.—In constructing the West Dike at Havre floating concrete caissons were built on land, set afloat, towed to and sunk into position on top of a rock embankment built above the bottom of the harbor. The length of the dike was 4,740 feet. Each caisson was 82 feet long, 19.68 feet wide, and 18.86 feet high. The lower third of the caisson had vertical walls, the upper two-thirds being built with a tumble-home so that the width of the caisson on top was about 11 feet. A longitudinal bulkhead, located 6 feet from the face wall and having the same general shape as the outside walls, divided the caisson into two compartments. After being sunk into position the outer compartment was filled with concrete, and the inner compartment with earth. On top of the caisson a regular sea-wall was constructed of brick work.

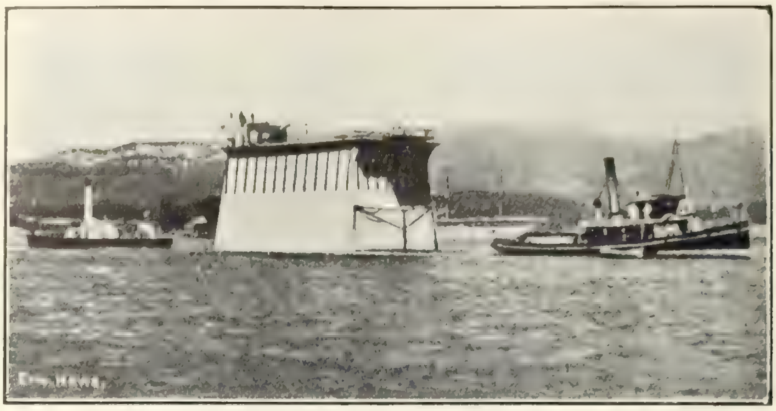
Egypt

Alexandria.—During the first half of 1911 a concrete lighthouse was constructed on the shore of Alexandria Harbor, Egypt, in the form of a reinforced concrete caisson, and floated out to its final position some four miles from its place of construction. The base of the structure consisted of a seven-sided slab, 8 inches thick, reinforced with one 12 by 24-inch longitudinal beam and five 8 by 16-inch transverse beams. The axial dimensions of the base were 37 feet by 41 feet. On top of the slab a hollow tower some 45 feet high, having tumbled-home sides and of the same general shape as the base, was erected. The shell or sides of the base tower were 6 inches thick, being strengthened by 8 by 12-inch vertical webs and 6 by 6-inch horizontal ribs. At the centre of the tower was located a 12 by 12-inch column with 8 by 8-inch struts extending out to the sides. Since the base of the tower was set in from the edge of the horizontal base, making a shelf, as it were, 5 feet wide, it was necessary to provide a series of brackets on the outside of the tower itself at its intersection with the base, and also to construct a rim or beam all round the outer edge of the horizontal base. A lantern tower, 36 feet high, was constructed on top of the base tower. This lantern tower was 12.3 feet in diameter at its base and 8.2 at its top, being well braced by 6 by 6-inch and 8 by 8-inch bracing struts and beams. The thickness of its sides was 4 inches.

The whole structure weighed about 1,700 tons, with a displacement of some 600 tons, resulting in a load of 1,100 tons on the sands. A 1:2:4 concrete with no waterproofing material was used.

In building this structure the flat base and 24 feet of the caisson tower were first constructed on land and then launched. The caisson was then built up to its full height while the structure stood alongside of a wharf. The lantern structure was also cast on shore, placed on top of the lower structure and made secure thereto.

The whole structure was lashed between two seagoing barges, with the tops of the upper and lower towers well guyed to the outer gunwale of the barges. An attempt was then made to tow the entire structure to its place of final location. When about half way on its journey the upper tower broke loose and fell over on to one of the barges without injuring the tower to any great extent. More damage is said to have been done to the caisson by the fall than to the tower, the latter being set upon shore as a land beacon. When the caisson finally reached its place of depositing it was sunk on to the prepared bottom by filling with water. The inside was then filled with concrete placed in the wet to such a height as to preserve the stability of the structure when pumped out. After the caisson had been unwatered the rest of the interior concrete was placed. The lantern tower was then built in place, and the structure as a whole completed. Though the tower was in heavy collision with a 4,000-ton steamer, it was not damaged, nor was its light put out at the



Torpedo station near Toulon, France. Towing caisson to its final site.

time of the collision, thus going to show what an amount of lateral pounding concrete will stand when properly made.

Italy

Genoa.—In the construction of a set of piers at Genoa, Italy, it was necessary to make use of floating concrete caissons in the construction of two of the said piers. Each caisson was 17 feet 3 inches by 13 feet 11 inches, and 36 feet high. The lower part was built with a cutting edge and a working chamber 6 feet high. The concrete walls were strengthened by two vertical webs on each side of the caisson with a series of struts across the interior from web to web. After being put afloat and towed to their final resting place in the harbor they were sunk into the mud by excavation in the air.

Russia

Whereas the Russian engineers seem to have made considerable study of the application of floating caissons to harbor development work, the authors have but one record of the actual use of such a type of structure on the part of the said engineers. Still, it is of interest to note in passing that in Russia as well as at Valparaiso and Stolpmunde, bottomless concrete caissons "set by means of metallic pontoons applied to the sides of the caissons" have been used. But such types of structures are foreign to the subject of this paper, and so will not be dwelt upon.

Tuapse.—The only record that the authors have of the actual use of floating concrete caissons on the part of the Russians is in connection with the construction of a jetty at Tuapse on the Black Sea. The length of the caisson was 56 feet, the width 21 feet, with heights of 6, 12, 9 and 22 feet, respectively. The weight of the largest caisson when empty was about 268 tons; when filled, about 1,600 tons. They were divided longitudinally by two partitions, the outer compartments being filled with a lean concrete, and the inner compartments with the same material less the cement. The caissons rest upon a riprap base, and so form the vertical part of the breakwater or jetty.

Japan

Kobe.—The most extensive use that has apparently been made of floating concrete caissons outside of Rotterdam is at Kobe, Japan, where large harbor improvements are under way at the present date. In the construction of four new concrete piers, reinforced concrete caissons—some 119 feet long, 35 to 40 feet wide, and 24 to 30 feet high, divided into twenty open-top cells by interior partitions, and weighing from 1,900 to 2,400 tons each—are being built in the dry on a pile structure on the shores of the harbor. After sufficient curing the caissons are lifted off their pile foundation by a specially designed depositing floating dock, carried into deep water, and put afloat by sinking the depositing dock and withdrawing it from underneath the concrete caisson. The caissons are then towed to and sunk in their proper places in the quay wall. When afloat the caissons drew about 25 feet. The exterior walls of the caissons are on the average a little over 1 foot thick, being built with a taper. The interior walls are of two different thicknesses, alternately 8 inches and 11 inches.

The land foundation upon which the caissons are built consists of seven groups of piling 15 feet apart, there being three rows of twelve piles in each group. The piling is properly capped with heavy timber running athwart the caisson, so as to permit the fingers of the lifting dock to be inserted under the caissons between each group of piling. The cost of the lifting dock was about $27,600. It takes two hours to put the caisson afloat.

Three building stages are used in the Kobe work, with an output of twelve caissons a year; three months being required to mold, mature, and put afloat each caisson. For building the seventy-nine caissons seven years will be needed. If the caissons had been built on a floating dry dock it is estimated that twenty years would have been needed to finish the work, or the use of five such docks for a period of seven years. Thus, while the lifting dock is used but at intervals, it is a far cheaper mode of construction than any other possible method.

The original conception of a "lifting-depositing dock" is due to John Standfield, of England, who has taken out English patents upon this type of structure. Whereas the idea at first did not find much favor, the principal reason, and the only one, as it appears, against such a mode of operation, was the doubt as to the possibility of building a concrete caisson that would have floating capacity. As above stated, the first application made of the idea of a "lifting-depositing dock" was at Barcelona, where the port engineer used the device "for picking off the depositing stages the ferro-concrete blocks which formed the extent of the harbor of Barcelona." From the success obtained at Kobe it would appear that the system of construction used by them is one worthy of deep consideration on the part of all harbor engineers.

New Methods of Odor Elimination at Garbage Plants

OFFENSIVE odors from New York City's garbage and dead animal disposal plants on Barren Island are to be eliminated by measures proposed by Irwin S. Osborn, of Toronto, and embodied in a report to the Board of Estimate and Apportionment, according to the Engineering Record. A number of changes in design and in operating methods are suggested, and a radical departure from present practice is advocated for treating the insoluble gases from the digester tanks of the reduction plant. These gases, after passing through condensers, have been discharged into the boiler furnaces and passed thence to the stack. Mr. Osborn's investigations, which are claimed to be the most complete of their kind ever undertaken, show that this heat treatment, instead of acting as a deodorizer, actually makes the gases more offensive. It does, however, render them soluble, so that the final process of treatment should be washing. Special attention also should be given, according to the report, to keeping all garbage digester tanks free from leaks, and to the installation and operation of condensers with an adequate water supply.

There are three so-called disposal plants at Barren Island, all privately operated, but under the general supervision of the Department of Street Cleaning. The largest is the garbage reduction plant of the New York Disposal Corporation. A fertilizer plant, where garbage tankage is dried, is operated by the Thomas F. White Company, and at a rendering plant dead animals are treated by the Products Manufacturing Company.

Garbage is delivered at the plant of the New York Disposal Corporation, the largest of its kind in the world, by scows, from which it is unloaded by grab buckets and discharged into scraper conveyors. Connecting the conveyors with digesters are swivel spouts which discharge the garbage directly into the digester tanks. The digesters are housed in two buildings, known as the New York building and the Brooklyn building. The New York digester building contains 68 digesters and the Brooklyn building 104 digesters. The digesters are approximately 6 ft. in diameter and 18 ft. long, constructed with a cone bottom, which is connected to a receiving tank by a large gate-valve and nozzle on the bottom of each digester. The garbage when cooked is discharged into the receiving tank, from which it is passed through a roller press, steam press, or hydraulic press, for extracting free water and grease.

Operation of Digesters

The digesters when filled are sealed by tightly closing the charging hole at the top, after which live steam is admitted at the bottom. The steam, entering the bottom, circulates up through the mass submerging it at from 60 to 80 lbs. pressure. After application of the steam from 6 to 10 hours, the garbage cells are broken down and the material thoroughly sterilized and digested. The top of each digester has a 2-in. vent line for relieving the pressure on the digester after the material has been digested. The 2-in. vent line is closed off by a valve during the cooking period and the gases allowed to escape through a 3/8-in. by-pass. The digesters in the Brooklyn building are arranged similar to those in the New York building, and vented in the same way through 6-in. main vent lines. The two 6-in. vent lines are carried to the end of the building, where they discharge into the digester vent tank.

Six-inch jet condensers are connected to the digester vent tank for condensing the steam and soluble gases. The discharge line from the condensers is connected to a blow-off tank, where the insoluble gases are trapped and the water overflows to the sewer. The blow-off tank is vented by means of a 4-in. line, which carries the insoluble gases and discharges them into the rear of the boiler furnaces, and thence with the combustion gases from the boilers to the chimney.

The garbage when cooked is discharged from the digesters into receiving tanks underneath, from which it is in turn passed through either roller, steam, or hydraulic presses. Water and free grease are pressed out, flowing through a conduit to grease-separating catch basins. The solids are delivered by conveyors to the drying building, the whole operation being carried on in closed apparatus.

Dryer Gases

The solids from the presses carried to the dryer building are fed into the primary direct heat dryers, which consist of a large circular shell with furnace at the feed end. The material is fed into the dryer, and as the dryer revolves the material cascades, coming in contact with the combustion gases from the dryer furnace, thus evaporating the moisture in the material. The dried material is discharged at the rear of the dryer into conveyors, which carry it to the percolating building. The vapors and gases coming from the dryers enter a large continuous chamber at the rear, which is connected to a flue leading to the chimney. The chimney, which is constructed of concrete, is 17 ft. in diameter and 225 ft. high, and not only takes care of the gases from the dryers, but also serves the majority of the boilers of the boiler plant. The dryer gases before entering the chimney are passed through a steel two-compartment scrubber, where the gases are passed through water spray to condense and take up the soluble gases. The scrubber was installed and placed in operation the latter part of 1914.

The dried material delivered to the percolating building is placed in extractors, and the grease left in the material extracted by means of a solvent. After treatment in the percolating building, it is carried by conveyors to the dryer building and passed through the secondary dryers, which are similar to the primary dryers, and the gases given off pass through a common flue to both sets of dryers, which in turn are connected to the scrubber. The dried material from the secondary dryers is taken by conveyors and industrial cars to the tankage storage building, ready for shipment.

The boiler house contains ten 200-h.p. and twelve 150-h.p. horizontal tubular boilers, which are connected by a flue to the concrete stack. In addition to the above boilers there are four water-tube boilers of 380 h.p. each, connected to separate steel chimneys. The water-tube boilers were installed in 1914. The total rated horse-power of boilers amounts to 5,320 h.p., the steam generated being used in cooking, pressing, percolating and operating steam engines and pumps.

Requirements for Odorless Plants

The type of equipment installed in the plants on Barren Island is similar to that found in the majority of reduction plants. In few plants has the required attention been given to eliminate the undesirable features. Odors from rendering or reduction plants have been due largely to improper equipment and apparatus or to careless operation.

To eliminate odors the following essential features must be considered: 1. The type of equipment used should be such as to produce a minimum amount of gas-carrying odors. 2. The equipment and apparatus used should be designed and installed so as to confine all odorous gases. 3. Proper and sufficient means must be provided to deodorize the gases produced. 4. The equipment and apparatus installed must be operated properly and efficiently.

Proper attention from a sanitary or free-from-nuisance standpoint cannot be expected when sufficient control as to the manner in which the work is to be conducted is not obtained by the municipality. When contracts are awarded in competition for short terms it usually results in the plants being constructed with less attention paid to details and permanent construction. It is an evident fact that when contracts are obtained it is necessary to charge off the larger part of the first cost of the plant during the life of the contract, and that the cost of operation will be increased when it is necessary to consider sanitation and freedom from nuisance as the first object. It is only natural to expect the commercial side to be foremost, unless proper control is exercised by the municipality, whether the work is conducted by contract or by the municipality.

Sources of Nuisance

The odors given off by the garbage reduction plant, causing nuisance to the surrounding territory, come principally from three sources—the gases vented from the digesters, gases escaping from the apparatus, and the gases from the dryers.

The gases carrying odors are treated at the reduction plant so as to eliminate a larger part of the odors, although they are not adequately or sufficiently treated. As previously described, the gases vented from the digesters are passed through condensers where the steam is condensed and a large part of the gases are absorbed by the water. The insoluble gases are trapped in a hot well or vent tank and then vented through a pipe line to the boiler furnaces, so as to raise their temperature sufficiently to deodorize them. From the tests made during this investigation it was demonstrated that by heating the gas to 2,000 deg. Fahr. the odors were not eliminated, but became more irritating as the temperature was increased, due to a change in the sulphur compounds to sulphur dioxide.

The practice of discharging the insoluble digester gases into the boiler furances has been universal in nearly all reduction plants. Mr. Osborn made tests in 1911 on deodorizing gases by heating to a high temperature, demonstrating that the gases could be completely deodorized. In conducting the tests water was used in producing suction on the test line leading to the high temperature furnace, so that after heating the gases were washed. The water was used only for siphoning the gases through the combustion chamber, the tests being made and a conclusion reached from the results obtained at various temperatures, while in reality, as demonstrated by the tests made during the Barren Island investigation, heating changes the sulphur compounds, producing a gas which becomes soluble in water.

The changes recommended call for abandonment of the present practice of discharging the insoluble gases into the boiler furnace, as, on being heated, they are given off with the odor caused by the chemical change.

The greatest source of the odors in the plant of the New York Disposal Corporation is the direct heat dryers used in drying the tankage. From determinations made approximately 175,000 cu. ft. of dryer gas a minute was given off. This gas, previous to the fall of 1914, was carried direct to the chimney and discharged to the atmosphere.

Washing Dryer Gases

In 1914 the company installed a scrubber for washing the gases, so that the odors would be absorbed before entering the chimney. Tests were made which showed that the odors in the gases from the dryers were absorbed by water, but that the scrubber now installed was not as efficient as it should be, due to its design and the manner in which it was operated. The velocity of gas, in passing through the scrubber, should be reduced to obtain effective results, and the application of the water should be such as to ensure the passing of the gases through sufficient curtains of sprays, to reduce the temperature and thoroughly wash them. To obtain satisfactory results the temperature of the gas should be reduced to 100 or 110 deg. Fahr, and the velocity should be at the rate of 300 to 350 ft. a minute, the quantity of water required depending on the quantity and temperature of the gases to be scrubbed.

The water should be applied so as to require all gases to pass through the curtains of water. The velocity of gas should not permit the water to be carried back or to short circuit, so as to prevent sufficient contact. The pressure on the spray nozzles should be such as not to offer too great resistance to the gas, and when using low pressure on the nozzles they should be spaced sufficiently near each other to give the desired curtains of water.

No attempt has been made by Mr. Osborn to state in detail what steps should be taken, and in just what way the work should be done, as it was the object of the investigation only to determine in what way it could be done and whether it was feasible.

Recommendations

As a result of the studies and investigations covered in this report the following recommendations are made for the New York Disposal Corporation plant:

1. That immediate changes be made in the treatment of the insoluble gases vented from digesters through condensers, so as entirely to deodorize them, as the present practice of discharging into the boiler furnace does not deodorize the gases.

2. That special attention be given to keeping all tanks containing digested garbage, or garbage in the process of digestion, free from leaks, and that equipment not absolutely free from leaks when under pressure be kept out of service until repairs are made.

3. That gases shall not be permitted to escape at the time of opening digesters.

4. That special attention be given to all condensers

to ensure sufficient water being used, and at a temperature that will condense all the steam and take up all soluble gases.

5. That the present dryer plant be so constructed or changed as to prevent leakage, and reduce the amount of gases to be treated.

6. That all gases given off from the dryers shall be scrubbed and deodorized thoroughly before being allowed to escape to the atmosphere.

7. That the scrubber now installed be replaced or reconstructed, to enable the volume of gas passing through it to be washed or scrubbed thoroughly.

8. That the water supply at the plant be increased, and, where necessary, pumps be duplicated to ensure sufficient water for condensing and scrubbing of gases at all times.

9. That the pumps be of a type that will assure the required amount of water being delivered, and that they be fitted with meters to show the amount used.

10. That the works and grounds at all times be kept in a clean condition.

11. That the city at all times have inspections made to determine the manner in which the work is being done.

The report is followed by a detailed account of investigations made at the Barren Island plants by the city's Central Testing Laboratory, under the direction of Otto H. Klein.

A Mercury Column Alarm for Water Standpipes[*]

By W. E. Haseltine[†]

FOR several years the company with which the writer is connected had trouble through the overflowing of its water standpipe. Since the standpipe is located in the residential district, its overflow caused a great deal of complaint from nearby property owners, who sometimes threatened damage suits. The company was also annoyed by the freezing of the overflow on the exterior of the standpipe.

There were three major reasons for this overflow occurring in the manner described, and for its continuing so long: (1) The standpipe is located nearly a mile from, and out of sight of, the pumping station. (2) The only means of telling when the standpipe was full was by the pressure gauge at the pumping station, and the indications of this gauge would vary so greatly with the speed at which the pumps were running, the amount of water being used from the mains, etc., that it was not very reliable as an indicator, and unless the pumps were stopped at a point considerably below full standpipe the engineer could never be sure that he was not running it over. (3) On account of the topography of the city, it was quite necessary to fill the standpipe almost to the top at every pumping to avoid an unnecessary amount of stopping and starting of the pumps and an increased pumping expense.

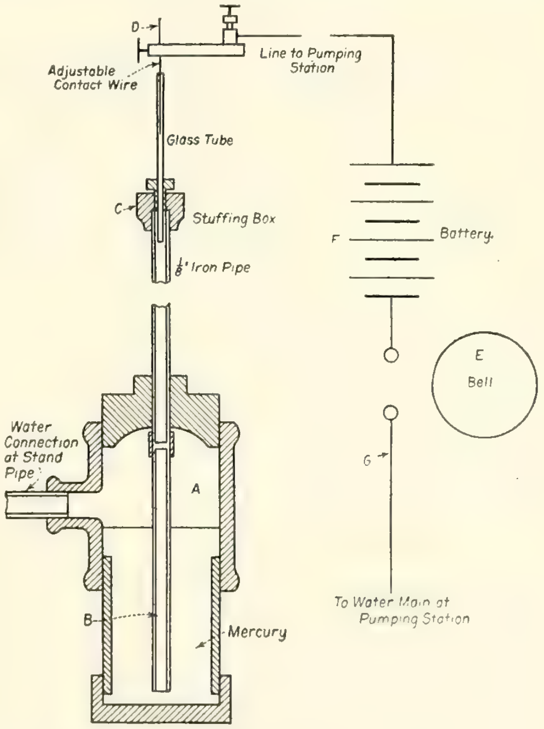
Many schemes were tried for correcting this condition, but with little success. A float making an electric contact was found impracticable on account of trouble with ice and excessive maintenance difficulties in other ways. A spring pressure gauge making an electric contact was also tried, but on account of damage from freezing this gauge had to be located in a damp valve pit underneath the standpipe, and the contacts consequently corroded and went out of business, and the gauge was also continually getting out of calibration.

The idea of a mercury column alarm then suggested itself, and after several attempts the manager succeeded in constructing one which has been in continuous service for almost nine years, and it has never failed to operate unless a wire of the pumping station has in some way been broken.

The accompanying drawing shows the general principle upon which this gauge is made and how it operates. A tap is made in the pipe leading into the standpipe on the standpipe side of the valve controlling same, so that the gauge will never be subjected to excessive fire pressures.

This tap is connected by means of a regular corporation connection to the top of the mercury chamber "A." Extending down into the mercury chamber is a small iron pipe "B" reaching nearly to the bottom, and this pipe extends vertically to a pre-determined height, and about 6 inches of glass tubing is connected to the top thereof by means of a stuffing box "C."

This glass tubing is placed at such a height above the mercury chamber that at the time the standpipe is full the mercury column will stand at about the centre of the glass tube. A metal contact "D" is arranged to slide up and down in this tube, and this is connected to the wire leading to the pumping station, and the electrical circuit completed by the bell "E," the set of batteries or bell ringing transformer "F," and the wire "G" attached to the water main at the station, this main making the return circuit.



Connections of mercury column alarm

The operation of the alarm is simplicity itself, the weight of the water column in the standpipe raising the column of mercury in proportion to its specific gravity until the mercury touches the contact "D," when the bell rings at the station. The specific gravity of mercury being about 13.6, a 100-ft. standpipe would require a mercury column something over 7 ft. high.

This alarm has a number of advantages over others.

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[*] Abstract by Engineering and Contracting of a paper before the American Waterworks Association.

[†] Manager, Ripon Light and Water Company, Ripon, Wis.

It is almost infallible, provided that the joints are made perfectly tight. It never has to be calibrated, and is independent of barometer and practically so of temperature. The latter statement is not strictly true, but it has been found that the gauge operates perfectly at all temperatures from 100 deg. above zero to 40 deg. below.

The fact that 1 in. of mercury is practically equivalent to 1 ft. of water makes it easy to set this gauge so that the point of ringing the bell at the pump house will not vary 1 inch in the standpipe, which cannot be said of an alarm based on any other principle.

The entire outfit can be made by any one at an expense not to exceed $20 or $25 outside of the line wire.

About the only precaution recommended is: Be sure to use an iron mercury chamber and iron pipe. Ignorance of the fact that mercury would attack brass was the cause of much grief at Ripon, and led to the loss of large quantities of mercury. The final mercury chamber was made out of a short section of 2-in. pipe and a riser out of ⅛-in. ordinary black pipe.

The Binder Course in Asphalt Pavements

By Robert Klotz*

PRESENT-DAY practice in sheet-asphalt and asphaltic or bituminous pavement construction for city streets, and discussions of defects in such pavements, show evidence of a constantly increasing tendency to overlook the purpose and importance of what is known as the "binder course," even to the extent of entirely eliminating this course or any substitute for it.

The various schemes and devices brought forward from time to time for the purpose of eliminating the wave effect met with in pavements of this character lead to the conclusion that a gentle reminder of the nature of and reason for the binder course might be of value to those interested in the question of economical pavement maintenance.

The purpose of the binder course is, as its name implies, to bind the top layer or wearing surface of the pavement to the base, whether the latter be of concrete, granite block, macadam, or other material. The mixture used for the wearing surface is designed to form, under compression, a reasonably hard, durable, and impervious covering, and being therefore comparatively low in bitumen has little if any power of adhesion.

The binder course originally used consisted of graded gravel thoroughly coated with coal tar, or coal-tar pitch, and laid at a temperature sufficiently high to provide for good adhesion to the base and to the surface layer.

The coal tar or pitch was later replaced by asphalt or asphaltic cement, presumably because of the increased difficulty of obtaining tar economically, due to the development of the water-gas process for the manufacture of illuminating gas and the consequent reduction in the quantity of commercial coal tar produced, and because of the decreased cost of the asphalt and its availability as part of the stock of the mixing plant. While the adhesive power of the binder thus produced was apparently lower than that of the tar-binder, it was still sufficient to provide the binding action required to prevent the forming of waves in the surface.

Within the last three or four years the various asphalt companies have introduced, apparently with a view to economy, what is commonly referred to as a close-mixture binder, which consists of broken stone screenings, varying from about a 1-in. size downward, covered with hot liquid asphalt. Owing probably to the reduced first cost of the pavement thus obtained, the use of this type of binder has been permitted under certain specifications, and quite a considerable area of this pavement has been laid.

The writer's experience with this type of binder, particularly on repair work, has shown that the old-style, or stone, binder is far more preferable and the one to be relied on to prevent the formation of waves in the pavement surface.

Owing to the decreased viscosity of the asphalt necessary to provide for the proper mixing of close-mixture binder, the coating on the particles of stone is comparatively thin. This makes the mixture subject to cooling below the critical temperature, within the time required for delivery and laying. The weight of the roller is more evenly distributed over the surface of contact between the binder and the base, and the pressure on the individual particles of stone is insufficient to bring the hotter portion of the more or less hardened coating into intimate contact with the base.

With new pavement the unfavorable behaviour of the "close mixture" is less evident than when an old pavement is repaired, due, no doubt, to the greater care and the more exacting supervision.

The action of an asphalt pavement where no binder course is used was brought very clearly to the writer's attention during 1912, when he was in charge of certain pavement repairs in the city of New York, all of the work being subject to the city's specifications and inspection.

During the early part of that year an order was issued to the effect that when repairs were required on asphalt pavements where the thickness of the original pavement, consisting of 1 in. of binder and a 2-in top course, had been reduced to 1½ ins. or less (that being the newly specified thickness of the top course), the binder course was to be omitted.

The writer managed to avoid almost entirely the forming of waves in the pavement, which he felt certain would be the result of literal adherence to this order, by having the base spattered or painted with a coating of hot liquid asphalt immediately before laying the top-course mixture, this asphalt acting as a very efficient "glue." Repairs made under the direct supervision of the city authorities on the same streets and subject to the same traffic, without the thin but effective layer of adhesive, showed waves within from two to three days after laying, and were destroyed by the action of traffic within two or three weeks.

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*Writing in Engineering News

While various theories have been advanced from time to time to account for the waves formed in asphalt pavements, some of them apparently based upon sound reasoning, practical experience seems to show that, whatever may be the particular action of traffic which causes them, waves can be avoided by providing a proper bond between the pavement proper and the base, and that three-wheel rollers, etc., are unnecessary and inadvisable complications to attempt to insert into the science of constructing and maintaining bituminous pavements.

An example of the need for special care in the construction of the binder course is shown in some work carried out by the writer in New York City in 1910, the area involving about 250 sq. yds. of sheet-asphalt pavement located in and around two underground-conduit car tracks with a double branch-off and curves, both being crossed constantly in the same direction by exceedingly heavy traffic. Frequent repairs had been required at this point owing to the rolling effect of traffic, the asphalt being continually forced against the rails and ground off as it reached the level of the head.

The re-laying of the entire area was required upon the reconstruction of the tracks, and the work was carried out during the night and the early morning to permit laying the pavement without seriously hindering traffic. Under the circumstances, the supervision of the city authorities was not as definite and exacting as might have been the case had the work been done
The total number of building permits for June3S
during regular hours; and as the sub-base was known to be of a sufficiently dry and porous nature to permit of the proper setting of the base, the asphalt was laid on the "green" concrete, which had been in place from 3 to 12 hours.

This pavement remained in place for over 2½ years under the same traffic conditions as previously, the only repair required being one small patch where the asphalt had been disturbed by a loose rail joint.

Sad to relate, this area was almost entirely removed in connection with subway construction at the end of the time mentioned. A more extended record of its behaviour would probably have been of considerable value, although the writer feels that the performance up to the time of removal was sufficiently marked to warrant more consideration of a proper joining of the pavement and the base than seems to be the practice at present.

Oil Paint on Cement

There is some difficulty in making paint adhere to cement, but if the cement is first washed with 1 per cent. of sulphuric acid (one part concentrated acid to 100 parts of water), rinsed, and allowed to dry thoroughly, the paint will find the surface suitably prepared for adhesion. Or the cement may be covered with three coats of water glass (silicate of soda), one part to four parts of water, and then painted. A first coat of linseed oil varnish followed by the usual paint is effective.

At Brantford, Ont., the total number of building permits for June was 136, while the total value was $154,030, an increase of $49,520 over the corresponding month of last year.

Complete Railway Aids Construction of Welland Ship Canal

In connection with the construction of the Welland Ship Canal a double-track railway with stone ballast and 60-lb. rails has been built by the Canadian Government. The railway extends from a point just north of the town of Thorold to Lake Ontario, a distance of seven miles, and its construction is for the purpose of handling excavated material from the canal prism to two long dumps in the lake forming the new Lake Ontario entrance to the canal, and for the handling of crushed stone excavated from the site of the flight locks in Thorold to the other lock sections of the canal to be used as aggregate for concrete. A large crushing plant has been erected with a capacity of 4,000 tons a day, and both this plant and the railway are now in active operation.

Since it is expected that during the summer, when all contracts are under way, there will be a train every five minutes, the entire line has been equipped with a block signal system.

The construction of the road was in charge of J. F. Pringle, railway engineer, under the direction of J. L. Weller, Engineer-in-Charge, Welland Ship Canal.

Cent Wise and Dollar Foolish

Saving in one way sometimes involves expense in other ways that more than offsets the prospective gain. The president of a prominent construction company states that in one case the saving of concrete by reducing the size of columns on successive floors was $2.30 per column. On the other hand, the increase in form cost was $5.70 per column, entailing a loss of $3.40 per column. This is a very good example of why it is cheaper to use the same size columns on successive floors than to reduce the dimensions. One way to avoid frequent changes in columns sizes is to vary column reinforcement in successive storeys.

A new kind of level for builders and others is designed to show the deviation from either horizontal or vertical in inches or fractions to the foot. It has a pan half-filled with colored spirit and covered with a glass face, and over this is a dial with two accurately graduated scales. The outer scale gives horizontal deviations, the inner making known the inclination from the vertical. The liquid, which is always level, is seen as a narrow semi-circular rim between the two scales and the reading at the end of this liquid curve may indicate the pitch of a rafter or other desired measurement.

The pneumatic method of placing concrete was used successfully for conveying the mix 2,805 feet through a 6-in. pipe on the Mile Rock tunnel work at San Francisco. The compressor capacity installed was 1,200 cu. ft. a minute, and the receiver pressure was kept at about 115 lbs. a square inch. This is regarded as a record for long-distance work of this character.

The building permits taken out during June at Kingston, Ont., covered work of an estimated value of $39,470, as against $16,797 for June of last year. The value of the work for which permits were taken out since the beginning of the year is estimated at $118,494. For the same period last year it was $176,072.

Method of Measuring Stone

IS there any fixed custom in the building trade as to the method of measuring up building stone? This was one of the crucial points debated in a case which came before Justice Elwood in the Supreme Court recently, when John B. Davies, contractor, of Saskatoon, sued Richardson Builders, Limited, for $2,821.85, the balance of an account which the plaintiff alleged was due for excavation and the cost of stone supplied for a building at the University. The particulars of the work done and material supplied were as follows: To excavating 4,367 yards at 35 cents a yard, $1,528.45; to excavating 652 yards at 45 cents, $293.40; to 350 cords of stone supplied, at $20 a cord, $7,000; total, $8,821.85. It was contended that $6,000 only had been paid on this account, leaving $2,821.85 due to the plaintiff.

On behalf of the defence it was contended that the total amount earned for excavation was only $1,636.10, and that this amount had been paid in full to the plaintiff, and, with respect to the stone, that only 260 cords had been supplied. The defence also contended that the price of the stone supplied by the plaintiff was $5,200, and that before the action was brought the defendant paid the plaintiff towards this amount the sum of $4,363.90, leaving an unpaid balance of $836.10. The defendants also stated that before the action was brought they assigned to the Canadian Bank of Commerce, Saskatoon, $477 on account of money unpaid to plaintiff by the defendant on the price of the stone. The defendant also paid into court in satisfaction of the plaintiff's claim, not including costs, $359.10, being the unpaid balance of $836.10 less the amount of $477 assigned to the Canadian Bank of Commerce.

Considerable interest was manifested in the case among the builders and contractors in Saskatoon. Evidence was given in support of the claim by the plaintiff and his son, and others, their evidence being chiefly with regard to the amount of stone which had been delivered as shown by various measurements. John Oliver stated that in computing the amount of stone supplied he took the length and width of the box wagons and the average height or sky-line of the load.

Geo. T. Clarke, vice-president and engineer for the defendants, swore that the total amount of the stone delivered was 260 cords, and that he arrived at this estimate by measuring the stonework in the wall in which the stone was used and adding thereto 28 per cent., which he said was the usual practice. He also took into consideration 12 cords remaining on the ground.

Frank Davies, son of the plaintiff, in the course of his evidence said that in one instance at least the amount contained in the loads must have been guessed at.

His Lordship, in giving judgment, said he must apply common sense in arriving at a decision, and it appeared to him that there was a strong probability that there had been a great deal of guesswork in arriving at the quantity of stone contained in the loads. He pointed out that there was a great deal of difference in measuring loads separately and measuring 640 loads of stone piled up, because it was impossible to get at the exact amount in each load, and therefore there would be 640 variations, and this might make a very considerable difference in the total. He considered that the weight of the evidence was in favor of the defendant, and there would be judgment for the plaintiff for $359.10, the amount paid into court and the costs up to the time of the action being brought, and judgment for the defendant for the costs incurred subsequently.

R. W. Davies appeared for the plaintiff, and Donald Maclean for the defendant.

Personal Mention

Mr. R. O. Wynne-Roberts, until recently Consulting Engineer to the city of Regina, has been elected a member of the American Society of Civil Engineers.

Mr. John Shaw has relinquished his duties as Town Engineer of North Bay, Ont. He is succeeded by Mr. H. McAuslan, who received much of his preliminary training under Mr. Shaw.

Mr. L. E. Carrothers, architect, of London, Ont., announces that he has opened an office at Room 58 in the Bank of Toronto Chambers in that city, and will be pleased to receive manufacturers' catalogues.

Mr. G. R. G. Conway was the guest of honour at a dinner given by the staff of the British Columbia Electric Railway on June 26th. The dinner was given on the occasion of Mr. Conway's retirement from the position of Chief Engineer to the company, in order that he may remove to Toronto and open offices as a general consulting engineer. He was presented by the employees of the company with a silver rose bowl.

Mr. W. A. McLean, Chief Engineer of Highways for Ontario, gave an address on the subject of good roads in the Town Hall at Owen Sound recently. Mr. McLean said that Grey County is in a position to build good roads as cheaply as any county in Ontario—the foundation is there already, the sub-soil for drainage is good, and the material for road-making is right at hand. Mr. McLean described methods of roadbuilding, and illustrated his remarks by lantern slides.

Mr. H. E. Tanner has been appointed City Engineer of Verdun, Que., in succession to Mr. Henry Hadley, Junr., who has resigned to go to the front. Mr. Tanner, who was born in Richmond County, Que., has been engaged in metallurgical research work at the Institute of Technology, Pittsburg, Pa. He was for two years assistant to the Town Engineer of Chicoutimi, Que., and also was engaged for three years on the engineering staff of the Transcontinental Railway.

Sapper George E. Revell, who is reported killed in action in Europe, enlisted for active service in Nelson, B.C., where he was practising his profession as a civil engineer. Sapper Revell was born in Woodstock, Ont., and graduated from the School of Practical Science of the University of Toronto.

The death is reported of Mr. Patrick McSherry, of Toronto. The late Mr. McSherry was a widely-known surveyor, having been connected with Government surveying work for many years.

One of Canada's oldest railway contractors, in the person of Mr. H. G. Taylor, died recently in Montreal at the age of 83. It was only a year ago that illness compelled Mr. Taylor to relinquish his duties as Mechanical Superintendent for the Montreal Tramways Company, a post which he had held since before the electrification of the system. He was born in Hampstead, N.H., and came to Canada at an early age. He was associated with the building of several railroads in Ontario and Quebec, including the Midland Railway, now part of the Grand Trunk System, and the Lake Erie and Detroit River Railway, now absorbed by the Pere Marquette Railway.

Mainly Constructional

East and West From Coast to Coast

Ontario Supplementary Letters Patent have been issued increasing the capital stock of the Swedish Crucible Steel Company of Canada, Limited, from $100,000 to $200,000.

L. A. Ott & Company, New Birks Building, Montreal, have received a contract for the grading of the battle fields of the Plains of Abraham, Quebec. The contract was awarded by the National Battlefields Commission.

The excavation for the new infirmary building on the mountain top at Hamilton, Ont., has been completed, and the form work is ready for the concrete. It is expected that the building will be completed early next winter, at a cost of $100,000.

The Montreal Board of Control have awarded to G. M. Gest, Limited, Montreal, the contract for the construction of 2,000 feet of underground conduit, with branch lines to outside lamp posts along the main line of conduit, in connection with the filtration plant now being constructed.

A tentative scheme has been submitted by Mr. Willis Chipman, consulting engineer, of Toronto, respecting the proposed extension of the sewage disposal plant at Guelph. He recommends additional filtration beds and the construction of a new septic tank at a cost of $55,000.

The Dominion Lime Company, Limited, has been incorporated at Madoc, Ont., with a capital stock of $100,000. The company are authorized to manufacture and sell Portland cement, marl, kirselguhr clay, bricks, lime, drain tiles, and artificial stone. The Provisional Directors are S. Wellington, C. R. Ross, and W. H. McBain, all of Madoc.

The Board of Works of Kingston, Ont., have appointed a sub-committee to take up the matter of relieving the City Engineer of some of his outside duties with a view to facilitating the work. It is proposed that an expert should be engaged to supervise the laying of pavements, and if any outside help is provided it will probably be along this line.

The Montreal and Southern Counties Railway Company are continuing their electric line to Granby, P.Q., an addition of 15 miles, the contract being carried out by the Grant Campbell Company. A sub-station will be built at Granby, making four sub-stations on the entire line of 46 miles. At present the extension is being graded, there being 250 men employed on this work.

With a capital stock of $25,000, the Carmichael Waterproofing Company, Limited, has been incorporated at Toronto, Ont., to manufacture and deal in all kinds of weatherproof building materials, including metal work, roofing, and building paper. The Provisional Directors are H. Howitt, B. F. Fisher, W. N. Robinson, G. R. Monteith, and P. N. Hotson, all of Toronto.

J. Chartier et Compagnie, Limitee, is the name of a company incorporated at Montreal recently, for the purpose of carrying on a general contracting business, erecting public and private buildings, and constructing canals, dams, bridges, piers, etc. The capital stock of the company is $50,000, and the incorporators include J. Chartier, J. F. Chartier, J. Bumbray and J. E. C. Bumbray, all of Montreal.

The Nova Scotia Car Works, Limited, have approached the city of Halifax for an advance of $135,000 to enable the company to start work on orders amounting to $400,000. Up till now the company have been unable to finance the work, but it is said that if the city will grant financial assistance the work can be started. The city have promised that the request of the company shall be considered.

It is understood that the Pease Foundry Company, of Brampton, Ont., have received an initial order for 100,000 shells. The manufacture of this quantity will give employment to thirty men for eight months. Mr. McKinnon, of the company, is in New York making arrangements for the installation of the necessary machinery. He expects to have a staff at work on the order within a short time.

Work will be started immediately on a three-storey building for the Merchants' Bank at Granville and Pender Streets, Vancouver, to be constructed at an approximate cost of $175,000. It will occupy the 50-ft. frontage on Granville Street where the Bank's main office now stands, and will have a depth on Pender Street of 104 ft. It is expected that the new building will be completed in about twelve months.

At a recent meeting of the Toronto Board of Control Mayor Church moved that the Works Commissioner report on the cost of establishing a civic car construction shop for the building and repairing of cars and other railway equipment needed by the city. This is the first step towards the establishment of facilities which will be needed when the city goes into the street railway business on a large scale.

At Lachine, Que., the Lachine Manufacturing Company, Limited, has been incorporated with a capital stock of $120,000, the incorporators being J. A. Descarries, T. N. Descarries, A. Descarries, R. LePailleur, J. A. P. Descarries, and J. W. LePailleur, all of Lachine. The company will manufacture metal work generally, including munitions of war, and for that purpose are authorized to act as contractors for public and private works.

Permission has been given by the Quebec Public Utilities Commission to the Laval Electric Company to carry their transmission line through the streets of the parish of St. Elzear upon condition that the company supply light and power to the municipality and residents upon the most favourable terms granted by the company. All questions regarding the location of the line and its erection and any difficulties that may occur will be adjusted by the Commission.

It is reported that more work is being done and more men are employed than ever before at the plants of the Nova Scotia Steel Company and the Eastern Car Works, New Glasgow, N.S. There are now 1,100 men on the Steel Company's pay-roll at New Glasgow, and it is understood that the Car Works will employ no less than 1,500 men as soon as they can secure them. Several departments of the Steel plant are working continuously with three eight-hour shifts a day.

The municipality of Montreal North have accepted plans for a main drainage scheme drawn up by Mr. F. C. Laberge, of Montreal, and have awarded the contract for the work to Mr. J. Chartier, Montreal, at the price of $127,000. The drains, which are to be constructed of concrete, will run the entire length of the town, and will discharge into the Back River at two points, the pipes being carried 600 feet into the river. The largest drains will be 2 ft. 4 ins. x 3 ft. 6 ins. The drainage of Pie IX Boulevard is included in the contract. At a later date it is intended to construct a purification plant, preliminary plans for which have been drawn.

The soundings of the Valley Inn Marsh on the route of the new Toronto-Hamilton highway have been completed. According to Mr. Macallum, City Engineer of Hamilton, solid clay was found in the marsh at a depth of between 40 and 50 feet. The result of the soundings will probably mean the adoption of Engineer Armstrong's scheme of a filled-in road across the marsh. Those in charge of the plans for the municipalities interested are expected to meet shortly and decide this point.

According to Mr. W. S. Kickley, the Local Manager, the Ford Motor Company of Canada contemplate the erection of an assembling plant in the city of Calgary, Alta., that will ultimately represent an investment of half a million dollars. The proposed construction involves the use of reinforced concrete. The Railways and New Industries Committee of the City Council have recommended that permission be given the company to cross Eighth Street West with a spur track, conditional on the erection of the structure.

Toronto's usual monthly announcement that work is to be commenced on the new Union Station by the first of next month has been made by city officials. The latest reason put forward for an early start, according to press reports, is an arrangement with the Bank of Montreal for advances of four million dollars on the guarantee of the Canadian Pacific and Grand Trunk Railways. Railway men are not so certain of the matter, however, and fail to see why the railroads should be willing to spend so much money on a new station when the old one can be made to answer for a time, at least.

Under the Mines Department of the Dominion Government an experiment is being made at Edmonton, Alta., to test McMurray asphalt as a paving material. The Mines Department will bear all the expense of laying the asphalt, while the city will lay the concrete base and curbs. A section of street 300 feet in length will be used for the experiment, half the distance being covered with a two-inch sheet of asphalt, and the other half with a three-inch layer of bitulithic—asphalt mixed with finely crushed rock. It is intended to find out which of these pavements gives the best results under equal traffic conditions.

The new Marine Drive extending from North Vancouver through the municipalities of West Vancouver as far as Caulfie, a distance of about ten miles, will probably be opened at the end of the month. The total cost of the work at present undertaken will be over $300,000, and it is only the beginning of a road that will be carried still further round the coast in course of time. It is the most ambitious piece of work yet attempted by the municipality of West Vancouver. There is no doubt that it will assist materially in putting that town on the map, as the new drive will form one of the finest automobile roads in the province.

Work on the Yonge Street subway at North Toronto has made such progress that Engineer Ripley is reported as saying that the road will be opened before it freezes in. The grading has been completed to the full depth of 18 feet, and the concrete work will start immediately. The water-mains have been lowered already, and the installation of Hydro wires, gas-mains, and telephone wires will be commenced without delay. The eastern abutment is completed to within 30 feet of the sound end, and this part of the work should be finished within another two weeks. Day and night work is being carried on with the concrete that will carry the bridge superstructure.

The Royal Bank of Canada have moved to their new quarters in the twenty-storey Royal Bank Building at King and Yonge Streets, Toronto. The Bank has leased the ground floor and a portion of the twelfth floor for a period of years. The groundwork in connection with the counters and railings is finished to harmonize with the color scheme of the interior marble, and the general lighting of the room is accomplished by concealed indirect reflectors arranged to ensure the best architectural effect. The executive and supervisor's offices will be on the twelfth floor, but they will not move from their old quarters till later on.

The committee representing the municipalities interested in the new Toronto-Oshawa road which was appointed at the recent meeting in Toronto (as reported in our last issue) met at Whitby last week and unanimously decided that the road should be constructed of macadam similar to that now in use on the Kingston Road from the Toronto city line eastward to the Grand Trunk crossing. Three engineers from the Department of Public Works, who went over the road previous to the meeting, were present to explain the plans. The Government is being asked to make an estimate for a standard grade of 3 per cent., the same as that on the Toronto-Hamilton roadway.

Rapid progress has been made on the foundation work for the Don Valley section of the new Bloor Street Viaduct, Toronto, during the last few weeks. Work is in progress on each of the six individual piers, which are in different stages of construction. At pier "B" the contractors tried a different procedure by excavating only half of the required foundation at once. One-half has been excavated and filled with concrete to a depth of ten feet. Considerable apprehension was caused by the close proximity of the excavation for pier "C" to the C. P. R. track; special precautions were taken to avoid a land-slide through the heavy traffic passing over the line. Between piers "C" and "D" an earth fill has been made varying in depth from three to six feet. At pier "D" concrete work is going on finely, and the first round of neat work has been completed. The concrete on this work is being placed through a chute from a tower with a bucket elevator. The excavation for pier "E" is partially completed, but contains about six feet of water. On account of the higher level the excavation for pier "F" has been comparatively easy, and no water has appeared to hamper the work. At present there are about 228 men employed on the work.

Mr. J. Stadler, of Shawinigan Falls, Que., writing on the subject of Quebec roads, criticizes the manner in which some highways are being constructed. For instance, certain portions of the new Three Rivers and Louisville road he considers will not be permanent owing to the material used and the method of drainage. On a trip from Three Rivers to Montreal he noticed that, instead of using large stones or boulders at the base of the road, sand and stone dust were employed. In other portions of the province, Mr. Stadler states, the work is bad—due, he believes, to insufficient supervision. In support of his contention that the base of the roads is poor and the drainage insufficient Mr. Stadler quotes the following report of some Swiss engineers who inspected many roads in Canada and the United States: "The northern part of America (Canada) has only a very few miles of road, and considering the short time these roads have been built we cannot consider the routes as a factor in our report. Our general observation, however, is that, having in mind the climatic conditions, the roads are built rather for apearance than for durability; the drainage—such an important factor in cold climates—is grossly neglected; the depth of the porous material in a good many instances is insufficient for the amount of traffic; and often the width of macadam road is too great to afford an economical investment."

Messrs. B. & S. H. Thompson & Company, Limited, of Montreal, agents for The Crittall Steel Casement Company, of Braintree, England, have secured the contracts for the steel casements for the new Civic Library at Montreal, and for the Ross Pavilion of the Royal Victoria Hospital.

The following contracts have been awarded to the Toronto Equipment Company, Limited: one from the city of Hamilton, Ont., for three 24 x 24 Chapman rectangular sluice gates, and one from the town of Transcona, Man., through the British Canadian Engineering Company, of Winnipeg, for two De Laval 8-inch vertical single-stage sewage pumps, having a combined capacity of three million gallons a day.

At Maisonneuve, Que., where road work is expected to amount to a million dollars this year, a departure from the ordinary method of constructing the concrete foundations for asphalt roads is being made by the Paving and Construction Company, who have the contract for the work. This departure is in the use of steel bar reinforcement. It is understood that the requirements for this material will amount to between eight and twelve hundred tons of ⅝-in. square twist bars in lengths of 25 feet and 32 feet. The Burlington Steel Company, Limited, of Hamilton, who have the order for the reinforcement, are supplying only rail carbon steel bars, on account of the requirements for a bar of high tensile strength.

Another successful example of the Canadian Blower & Forge Company's Exhaust Systems is the one installed for the British Insulated & Helsby Cables Company, Limited, Prescot, Lancashire, England. The fan used is a No. 45 Canadian slow speed, high efficiency mill exhauster with direct connected motor. Fifteen machines and six floor sweeps are served, and the system is operating well, requiring 6 h.p. for the motor. The unusually good result is due as much to the design of the piping as to the high efficiency of the fan itself, which is operating at a pressure of less than three ounces, and with a uniform velocity in the pipes of less than 3,000 feet a minute. This low velocity is possible only when the frictional resistance is estimated carefully, so that the draught at every hood is the same; in fact, a sweep-up at the end of the exhaust pipe has just as good a suction as the hood nearest the fan. The discharge from the fan is carried about 100 feet outdoors to a cyclone collecter in the boiler house. The total length of the system is 280 feet.

Trade Inquiries

The Weekly Report of the Department of Trade and Commerce contains the following inquiries relating to Canadian trade. The names and addresses of the firms making these inquiries can be obtained by those specially interested in the respective commodities upon application to the Inquiries Branch, Department of Trade and Commerce, Ottawa:

760. **Pipe-wood staves.**—A South African commission house requests correspondence with complete information on patent wood staves for water pipe lines. Full particulars are requested in reference to the tools required for putting these pipes together, as they will have to be shipped in the knock-down state.

762. **Railway material, locomotives, etc.**—A London correspondent who has for some years been the representative of large continental manufacturers of railway material, locomotives, gas engines, etc., is open to act as agent for Canadian manufacturers.

765. **Machinery, hardware, building materials, etc.**—A firm of engineers in London wishes to get into touch with Canadian firms manufacturing machinery, hardware, building materials, etc., who seek agents in the United Kingdom or selling agents in South Africa and other parts of the Empire.

797. **Gas tubes.**—A firm in Birmingham are in the market for gas tubes, and would like to hear from Canadian manufacturers.

798. **Carborundum discs.**—A Dutch firm are in the market for carborundum discs, 30 cms. in diameter, with a central hole of 35 mm., made of steel with borders of carborundum 6 mm. width, for shipment to Spain, and would like to hear from Canadian manufacturers.

802. **Representation in Great Britain.**—A British firm with good connections in the building and engineering trades throughout Great Britain desire to represent Canadian producers of standard lines, particularly asbestos, timber, railway sleepers, etc.

804. **Annealed and barbed wire, wire nails, etc.**—A London firm wish to obtain quotations from Canadian manufacturers of annealed and barbed wire, wire nails, etc.

808. **Hack saws.**—An engineering firm in Barbados would like to have catalogues and illustrations from Canadian firms manufacturing small engineering machinery, particularly hand and power hack saws.

810. **Explosives.**—A manufacturers' agent in Buenos Ayres would like to enter into communication with Canadian explosive manufacturers.

811. **Manganese castings and Decouville wagons.**—A British firm of engineers and importing merchants, well known in Buenos Ayres, who handle all kinds of heavy machinery, iron, steel and wire, desire to import manganese castings, manganese rail joint castings, and Decouville wagons.

814. **Trade with Russia.**—One of the largest houses in Moscow, who specialize in trade with Siberia, where they have ten branches, are in the market for the following, and would be pleased to hear from reliable Canadian firms: Bolts and nuts; gas tubing, iron; boiler tubes, iron; wire nails; wire of all kinds, including barbed wire; portable engines; rock drilling machines; metal turning lathes; miners' shovels; chemicals, heavy; calcium carbide; acetate of lime; coal tar products—viz., pitch, carbolic acid, creosote, sulphate of ammonia, sulphate of soda; graphite; news and printing paper; wrapping and packing paper.

815. **Steel bars.**—A correspondent in England desires the addresses of Canadian manufacturers who have representatives in Great Britain and who are in a position to supply bars for ferro-concrete purposes. These are ordinary mild steel bars for a tensile strength of from 28 to 32 tons to the square inch.

Attention may be called to Trade Inquiry No. 814, which has been forwarded to the department by Mr. C. F. Just, Special Trade Commissioner to Russia. This inquiry refers to one of the largest houses in Moscow, who specialize in trade with Siberia, where they have ten branches, and who are in the market for the goods listed, and would be pleased to hear from reliable Canadian firms.

Quotations should be c.i.f. Vladivostok, with best terms. This firm have done a large business with Germany on long credit. Reasonable credit is expected. In sending catalogues five copies are required for use of the head office in Moscow and branches in Siberia.

The mining shovel used in Siberia is made for the market in the following weights and sizes, with well riveted handle socket, and in the curved pointed shape:—

No. 1	330	275	1.300
No. 1½	330	300	1.500
No. 2	340	290	1.500
No. 3	360	295	1.700

Quotation per 100 kilogrammes.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Canora, Sask.
The Town Council are considering the installation of a waterworks system at an estimated cost of $17,700. Engineers, Chipman & Power, Mail Building, Toronto.

Chatham Township, Ont.
Tenders will be received until July 17th by W. H. Wickens, Scane Block, Chatham, for the construction of a dam, dredge drains and dash wheel and the installation of pumping machinery. Engineer, W. G. McGeorge, 153 Queen Street, Chatham.

Tenders on the construction of Sylvester Drain will be received until 1 p.m. July 17th, by Commissioner J. A. Miller, Lot 12, Concession 7, Eberts. Plans and specifications with the Engineer, W. J. McGeorge, 153 Queen Street, Chatham.

Fort Erie, Ont.
The Municipal Council have received tenders for the construction of a macadam road from North Line to Buffalo Ferry. Clerk, W. Simmons.

Grimsby, Ont.
Plans have been prepared for watermains to be laid under the supervision of the Town Engineer, C. Bromley. About 8,000 feet of 4-inch pipe will be required.

Guelph, Ont.
The City Council have been ordered by the Provincial Board of Health to lay iron watermains between Victoria Bridge and the Pumping Station. Chairman of the Water Commission, G. B. Ryan.

Lavant Township, Ont.
The Township Council have passed a by-law providing for the construction of a road from Lavant Station to Folger. Clerk, W. Browning, Lavant Station.

Matheson, Ont.
A by-law, providing for the installation of a waterworks system, will be submitted to the ratepayers on July 16th. Estimated cost, $20,000. Clerk, F. R. Rockall.

Niagara Falls, Ont.
The City Engineer, F. J. Anderson, will receive tenders until noon, July 19th, for laying about 50,000 square feet of concrete sidewalk, and 9,000 feet of curbing.

St. Thomas, Ont.
The Town Engineer, M. Ferguson, has submitted two plans for sewage disposal, estimated to cost $15,000 and $9,500 respectively.

The Pas, Man.
The installation of a waterworks and sewage system is contemplated by the Town Council. Approximate cost, $80,000. Clerk, H. H. Elliott.

Thurlow Township, Ont.
Tenders on the construction of a quantity of cement sidewalks will be received until July 20th by W. C. MacDonald, Belleville, R. F. D. 109.

Toronto, Ont.
Permission has been granted to the Board of Control to construct a permanent road bed for a street car line on Bloor Street West, from Dundas Street. Estimated cost, $125,000.

The York Township Council have been asked by Engineer E. A. James, 57 Adelaide Street E., Toronto, to pass a by-law for the construction of an asphalt roadway on Dundas Street west of the city limits. Approximate cost, $19,000.

Vernon, B.C.
The Municipal Council are considering the construction of an auxiliary pumping station, estimated to cost $3,000. One large capacity pump and 50 h.p. motor will be required. Clerk, D. G. Tate.

Winnipeg, Man.
The Board of Control will call for tenders shortly on the construction of a sewer on Stafford Street. Secretary, M. Peterson.

The laying of watermains on Wellington, Cambridge and Academy Streets is being considered by the Board of Control. Engineer, W. P. Brereton.

CONTRACTS AWARDED

Cayuga, Ont
The Town Council have let a contract for laying concrete sidewalk to Frank McMullen, Cayuga, at 10c per square foot.

Ingersoll, Ont.
The contract for the construction of brick pavement, curbs and gutters on Thames and King Streets has been let by the Town Council to the Municipal Construction Company, Berlin, at $2.60 per square yard. Approximate total cost, $18,200.

London, Ont.
The City Council have let the contract for laying asphalt pavement on York and Talbot Streets to the Standard Paving Company, Central Chambers, Ottawa, at $34,000.

Toronto, Ont.
The Board of Control have awarded the contract for the construction of sewers on Dundas Street to Longo & Gentile, 663 Markham Street, at $4,650.

Transcona, Man.
The Town Council have let the contract for the supply of sewage pumps to the British Canadian Engineering & Supply Company, Limited, 122 Phoenix Building, Winnipeg.

Windsor, Ont.
The City Council have let the contract for the supply of cast iron water pipe to the National Iron Works, Limited, Cherry Street, Toronto, at $30.25 per ton, and for specials, valves, hydrants, etc., to the Kerr Engine Works, Walker Road, Walkerville.

Railroads, Bridges and Wharves

Chatham Township, Ont
Tenders on the erection of four steel and concrete bridges will be received until July 17th by James A. Miller, Eberts.

Haldimand & Simcoe Counties, Ont.
Tenders on the construction of a reinforced concrete culvert will be received until July 21st by G. Hammond, R. R. No. 2, Port Dover, and E. Boughner, Colborne Street, Simcoe. Plans and specifications with the Engineer, G. R. Marston, Simcoe, and W. G. Clarke, R. R. No. 5, Hagersville.

Lanark County, Ont.
The County Council are considering the erection of a bridge. Clerk, W. A. Moore, Perth.

Summerville, Ont.
Extensive repairs to a bridge on Dundas Street have been decided on. Clerk to York County Council, R. W. Phillips, 57 Adelaide Street East, Toronto.

CONTRACTS AWARDED

Bruce Township, Ont.
The following contracts for bridge construction have been let by the Township Council:—Willow Creek Bridge, cement work, J. A. McKinnon, Paisley R. R. No. 20, and steel work, Hunter Bridge & Boiler Company, Queen Street, Kincardine; Base Line Bridge, general contract, R. Begg, Port Elgin.

Dorchester North Township, Ont.
The contract for the erection of three concrete bridges has been let by the Township Council to R. E. Waltham, Parkhill, and J. F. McLean, Lucan.

Grand Bend, Ont.
The contract for the construction of two cement bridges for the Huron County Council has been let to J. Lawson, Crediton P.O.

Public Buildings, Churches and Schools

Berlin, Ont.
Tenders on electric wiring and fittings for the Post Office will be received until 4 p.m., July 23rd, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications with T. A. Hastings, Postal Station F, Toronto, at the Post Office, Berlin, and at the Department. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

East Kildonan, Man.
The Municipal Secretary, H. Thomson, will receive tenders until July 19th for alterations to a building for a Municipal Hall. Plans prepared by the Municipal

Engineer, 216 Chambers of Commerce Building.

Fort William, Ont.
Work has been commenced on the erection of the Registry Office. Contracts for heating, plumbing and electric lighting have not been let.

Hamilton, Ont.
Tenders on the erection of a fire escape at the City Hall will be received until July 20th by the Mayor, C. S. Walters. Plans and specifications at office of the Clerk, S. H. Kent.

Huff's Island, Ont.
Tenders on the erection of a school will be received until July 19th by the Chairman of the Board of Trustees, W. Barber, Belleville. Architect, G. A. Bennett, Victoria Avenue, Belleville.

Matchedash & Tay Townships, Ont.
Plans of a school are being prepared by J. H. Robertson, Orillia, for the Trustees of School Section No. 16. Brick construction, metal roofing. Estimated cost, $4,500.

Montreal, Que.
A permit for the erection of a hall has been issued to the Trustees of St. James Roman Catholic Church, St. Catherine and St. Denis Streets. Approximate cost, $3,000. Work by day labor.

Rothsay, N.B.
Tenders on the erection of a five-roomed brick school are being received by F. Neil Brodie, Architect, 42 Princess Street, St. John.

Union Bay, B.C.
Tenders on the erection of a two-roomed school will be received until noon, July 17th, by J. E. Griffith, Deputy Minister of Public Works, Victoria. Plans and specifications at offices of J. Baird, Government Agent, Cumberland, B. C., George Thomson, Government Agent, Nanaimo, J. Mahone, Government Agent, Vancouver, W. Haggart, Secretary to the School Board, Union Bay, and at the Department.

Whonnock, B.C.
Tenders will be received until noon, July 17th, by J. E. Griffith, Deputy Minister of Public Works, for the erection of a one-roomed addition to the school. Plans and specifications with J. A. Mahoney, Government Agent, Vancouver; F. C. Campbell, Government Agent, New Westminster; J. B. Martyn, Secretary to the School Board, Port Haney, and at the Department, Victoria.

CONTRACTS AWARDED

Beverly, Alta.
Henry Walk, Chaplin Street, is erecting a school, estimated to cost $13,500. Heating, painting, and plastering will be sub-let. Brick veneer construction.

Elmwood, Man.
Work is under way on the erection of an addition to the King Memorial Church, Coburg Street. The general, masonry, carpentry, roofing, plastering, and painting contracts have been let to Worwswick Bros., 123 Hart Avenue, the contract for iron work to the Western Steel & Iron Company, Limited, Chalmers, and for electric work to Price & McDonald.

Montreal, Que.
The contract for the erection of a fire escape at the school on Sherbrooke Street has been let to Bonnell Bros., 341 Guy Street, at $3,610.

Quebec, Que.
The contract for waterproofing the basement of the Customs House has been awarded by the Department of Public Works, Ottawa, to the Standard Paint Company of Canada, 52 Victoria Square, Montreal.

Toronto, Ont.
The Department of Public Works, Ottawa, have let the contract for the installation of interior fittings at Postal Station G to the Berlin Interior Hardwood Company, Limited, 72 Wilmot Street, Berlin.

Westboro, Ont.
The School Board have let the painting contract in connection with the school in course of erection on Euclid Street to Basil T. Thomas.

Business Buildings and Industrial Plants

Brussels, Ont.
John Currie & Son have purchased a site, on which they propose to erect a slaughter house.

Clinton Township, Ont.
C. Hendershot, Beamsville, contemplates extensive alterations and additions to his farm buildings. Brick and frame construction.

Fort William, Ont.
The erection of stores on Victoria Street is contemplated by I. C. Murray, Murray Block. Architect, L. W. Allen, care of owner. Work will be done by day labor, with the exception of heating, which will be sub-let. Approximate cost, $7,000.

Work has been started by day labor on the erection of a drying plant for N. M. Patterson & Company, Limited, Fort William West. Frame construction, concrete foundation, corrugated iron roofing. Approximate cost, $5,000.

Kentville, N.S.
Work has been commenced on the erection of a drug store on Main Street for W. W. Rockwell. Frame and brick construction.

Okanagan Landing, B.C.
The erection of a station, round house and turntable is contemplated by the Canadian Pacific Railway. Divisional Superintendent, J. F. Richardson, Vancouver.

Ottawa, Ont.
Work has been started on the erection of stables for J. Torontow, 27 McGee Street. Frame construction, concrete foundation. Work by day labor.

The Healey Cartage Company, 59 Botelier Street, have had plans drawn for coal sheds, conveyors, etc., estimated to cost $4,000. Frame and ironclad construction, concrete foundation, corrugated iron roofing. Motors will be required.

Work has been started by day labor on the erection of a warehouse for O. Petegorsky, 20 Stewart Street. Estimated cost, $5,000.

An addition to the Davidson Wood Factory on Wellington Street is contemplated by the Davidson Estate. Mill construction, corrugated iron roofing. Woodworking machinery will be required. Manager, L. Henderson, Wellington Street.

The garage in course of erection for Mederic Landreville, Albert Street, is being built by day labor. Material is purchased by owner.

Petrolia, Ont.
Josh Bros., Wonderland Theatre, are about to fit up premises as a moving picture theatre.

Port Dover, Ont.
The erection of a steel pavilion is being considered by Morley Buck.

Stamford Township, Ont.
C. M. Borter, Main Street, Niagara Falls, is preparing plans of a barn for H. D. Symmes, Culp Street, Niagara Falls South.

Toronto, Ont.
Tenders will be received until July 17th by J. C. Forman, City Hall, for alterations to the store building at 756 Broadview Avenue and for the removal of the old building at 754 Broadview Avenue.

The Board of Control have instructed Propery Commissioner D. Chisholm to prepare plans for a barn to be erected at the Men's Industrial Farm. Approximate cost, $25,000.

CONTRACTS AWARDED

Hamilton, Ont.
Work is in progress on alterations to a hotel at Main and Hughson Streets for L. Munroe, Freeman Place. The general, masonry, carpentry, steel and roofing contracts have been let to S. Hamard, Mary Street. Plastering, painting, heating, plumbing and electrical work still to be let. Approximate cost, $4,000.

Farewell & Guest, 167½ King Street E., have let the masonry contract in connection with the theatre which they are building to B. Barnes, 53 Cheener Street.

Ingersoll, Ont.
Work has been started on alterations to the factory of the John Morrow Screw Company. The masonry, steel and roofing contracts have been awarded to Sinclair & Woodhall, 105 Sandford Avenue S., and the carpentry contract to L. J. Beatty, 175 Emerald Street S. Plastering not let.

London, Ont.
Work has been commenced on the erection of a store for A. Hartman & Shabsove, 200 Dundas Street, by the general contractors, R. Parsons & D. Ross, Maitland Street. Brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,000.

Work is about to start on improvements to business premises for Hubert Dignan, Registrar's office. The masonry contract has been let to Scott Murray, 564 King Street, and the carpentry contract to S. Willis, 765 Talbot Street. Estimated cost, $3,500.

The general contract for the erection of nine stores on Dundas Street E. for J. M. Moore, 478 Waterloo Street, has been let to N. Southern, Renwick Avenue. Smaller trades will be sub-let. Brick construction, felt and gravel roofing. Approximate cost, $10,000. Work has been commenced.

Niagara Falls Centre, Ont.
Work has been started on the erection of a store by Paomeffa Bros., Niagara Falls Centre. The heating contract has been let to O. C. Gray, Queen Street, Niagara Falls. Contract for electrical work not let.

Ottawa, Ont.
In connection with the garage being built for Parkers Dye Works, Limited, 211 Sparks Street, the heating and plumbing contract has been let to J. P. Bland & Company, 775 Bank Street.

In connection with the theatre in course of erection on Queen Street for B. Stapleton, the contract for lathing has been let to A. Desjardins, 555 St. Patrick Street, and for heating and plumbing to A. Gauthier & Company, 307 Dalhousie Street.

St. Thomas, Ont.
Work has been commenced on the erection of an office building for Perry King, 4 Southwick Street. The masonry contract has been let to A. E. Ponsford, 605 Talbot Street, the carpentry contract to E. Reath, 56 Southwick Street, the plastering to I. Stewart, St. Thomas, the contract for painting to E. Dallyn, St. George Street, and for metal work to Ingraham & Davey, 468 Talbot Street.

Welland, Ont.
In connection with the remodelling of a store for A. J. J. Brennan, 7 Main St. E., the carpentry contract has been awarded to J. C. Diffin, Brennan Block, the contract for a store front to the Kawneer Company, Richmond and Yonge Streets, Toronto, and for flooring to B. Timms.

Windsor, Ont.
In connection with alterations to a billiard parlor on Pitt Street for Malcolm McGregor, the contract for roofing, heating and plumbing has been let to Pennington & Brian, 47 Sandwich Street W., the painting contract to T. W. Brooke & Son, 6 Pitt Street W., and the masonry and carpentry contract to the general contractor, R. Westcott, 55 Oak Avenue.

Winnipeg, Man.
In connection with the bakery in course of erection for N. Segal, 510 Selkirk Avenue, the masonry and plastering contracts have been let to Fred Temchuck, Magnus Avenue, and the contract for steel work to the Manitoba Bridge & Iron Works, Logan Avenue W.

The general contract for the erection of stores for W. & J. McBain has been awarded to Fraser & McDonald, 512 Gertrude Avenue. Brick construction, stone foundation, felt and gravel roofing. Approximate cost, $7,000.

Residences

Aylmer, Que.
Gabriel Proulx, Main Street, has commenced the erection of a residence, estimated to cost $3,000. Brick veneer construction, concrete foundation, felt and gravel roofing.

Aylmer, Ont.
J. T. Findlay, 386 Talbot Street, St. Thomas, is preparing plans of a residence to be erected here for Oscar Smith, Port Stanley, at an estimated cost of $3,000. Red brick construction, slate roofing.

Plans are being prepared for a bungalow for C. H. White. Architect, J. F. Findlay, 386 Talbot Street, St. Thomas. Stone and brick construction, tile roofing. Estimated cost, $3,500.

Clinton, Ont.
Plans of a residence are being drawn by F. B. Hoffman, Beamsville, for A. L. Whitelaw, Beamsville. Frame construction, concrete foundation, metal roofing. Estimated cost, $3,500.

Grimsby, Ont.
William Schwab is preparing plans of a residence, estimated to cost $3,600. Frame construction, stone foundation, shingle roofing.

Hull, Que.
T. Lacelle, Bourque Avenue, is building a residence by day labor. Brick construction, composition paper roofing. Approximate cost, $4,000.

Kentville, N.S.
Work has been started on the erection of a frame residence on Main Street for J. W. Cross.

Stanley D. Wolfe is building a residence on Main Street. Frame construction.

H. F. Eaton is building a frame residence on Klondyke Street.

Linsdale, Alta.
Plans of a residence have been drawn for E. Harding, by P. M. Clemens, 331 Garry Street, Winnipeg. Frame construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

London, Ont.
The erection of two bungalows is being considered by Whit Lancaster, 1 Stanley Street S. Buff brick construction. Estimated cost, $5,000.

Milton, Ont.
The tenders received for the erection of a jailer's residence for the County of Halton were unsatisfactory. New tenders will be called when the plans are completed. Architects, G. M. Molesworth and G. M. West, 2 College Street, Toronto.

Montreal, Que.
Work has been started by Henry Heider, 369 Rivard Street, on the erection of three residences, estimated to cost $3,000.

O. Lafortune, 325 Notre Dame de Grace Street, is building a residence on Wilson Street, estimated to cost $3,500.

Ottawa, Ont.
The erection of a residence on Gilmour Street is being considered by W. Ellard, 77 Cambridge Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $3,500.

J. R. Rady, 428 Lisgar Street, has plans drawn for a residence, estimated to cost $6,500. Brick veneer construction, brick foundation, shingle roofing.

W. E. Noffke, Architect, Plaza Building, Rideau Street, is preparing plans for alterations to apartments on Slater Street for the H. N. Bate Realty Compan, Canal Street.

Quebec, Que.
Work has been started on the erection of a residence by T. Martin, 53 Sacre-Coeur Avenue. Work by day labor. Brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $5,000.

Work has been started on the erection of a residence on Canardiere Street by J. Carmichael, Notre Dame des Laurentides Street. Frame and brick construction, metal and asbestos roofing. Estimated cost, $6,000.

Roderick, Sask.
Plans of a residence have been drawn for W. A. Duncan by P. M. Clemens, 331 Garry Street, Winnipeg. Frame construction, concrete foundation, shingle roofing. Estimated cost, $4,000.

Toronto, Ont.
R. J. Marshall, 60 Rosemount Street, is building a residence at 9 Glenholme Avenue, estimated to cost $3,500. Brick construction, shingle, felt and gravel roofing.

T. J. Allen, 48 Oakmound Road, has commenced the erection of a pair of residences at 66-68 Boon Avenue, estimated to cost $3,600. Smaller trades will be let. Brick construction.

Work has been started by W. Williams, 33 Cloverdale Road, on the erection of a pair of residences at Morrison and Day Avenues. Brick construction. Estimated cost, $4,000.

Tenders on the electrical work required in the erection of a residence are being received by J. J. Matheson, 1279 Dundas Street.

A residence is being built at Beach and Balsam Avenues for R. H. King, 415 Indian Road. Tenders on smaller trades are being received by the owner. Approximate cost, $3,500.

Tenders on electric wiring for three houses are being received by J. Guinane, 9 King Street W.

Uxbridge, Ont.
T. R. Ferguson, Brock Street, is receiving tenders on all trades excepting carpentry required in the erection of a residence, estimated to cost $6,000. Plans and specifications with Mr. Ferguson.

CONTRACTS AWARDED

Bowmanville, Ont.
The contract for the erection of a parsonage for the Methodist Church has been let to Gay Bros., Limited, Courtice Street.

Bridgeburg, Ont.
Work has been started on the erection of a residence by J. C. Purvis. The masonry contract has been let to Albert Nie, Fort Erie. Estimated cost, $3,500.

Chatham, Ont.
James E. Gray, 37 Grand Avenue, has let the general contract for the erection of a residence to Frank Sparks, Sandys Street, and the plumbing contract to J. W. Draper, 4 Fifth Street. Brick construction, shingle roofing. Approximate cost, $3,500.

Grimsby, Ont.
The general contract for the erection of a residence on Fairview Avenue for J. Harrison has been let to D. Marsh & Son. Frame and concrete construction, shingle roofing. Approximate cost, $4,000.

Hagersville, Ont.
J. W. Seymour has let the masonry

contract for the erection of a residence to E. Hannah, and the carpentry contract to G. Smith.

Halifax, N.S.

Work has been started on the erection of a residence for I. S. Roper. The contract for heating and plumbing has been let to G. Perrier, 35 Granville Street, and for electrical work to Farquhar & Company, Limited, 163 Lower Water Street.

Hamilton, Ont.

E. W. Vivian, 408 Barton Street E., has let the general, masonry, carpentry, steel and roofing contracts for the erection of a residence to F. Babbidge, 688 Concession Street. Contracts for plastering, painting, heating, plumbing, and electrical work not yet awarded. Estimated cost, $4,000.

London, Ont.

Dodd & Son and Scott and Murray, 448 King Street, have commenced the erection of a residence for A. Fraser, 7 Horn Street. Brick construction, concrete foundation, slate roofing. Approximate cost, $4,500.

Maisonneuve, Que.

In connection wit the residence being erected by H. Bernier, 758 Adam Street, the contract for tile work has been let to Calkins-Leete, Limited, 1013 St. Catherine Street W., the plastering contract to J. Perron, 279 Moreau Street, the heating and plumbing to G. Lamoth, 190 LaSalle Avenue, and the contract for electrical work to Trudeau & Belleau, 273 Valois Street. Painting will be done by owner.

Ottawa, Ont.

The contract for the erection of a residence for Harry Morrison, 139 Stewart Street, has been let to Bower Bros., 133 Hopewell Street. Stone foundation, brick construction, shingle roofing. Approximate cost, $4,500.

The general contract for alterations and additions to the residence of J. A. D. Holbrook, 25 Cliff Street, has been awarded to S. F. Smith, 448 McLeod Street. Approximate cost, $7,000. Brick construction, stone foundation, shingle roofing.

In connection with the residence being built on Irving Stret by W. C. Leech, 140 Spadina Street, the plastering contract has been let to T. H. Patterson, 70 Rosedale Street, the contract for heating and plumbing to Slater & Nicholson, Kent and Slater Streets, and for electrical work to C. Presby, 138 Irving Street.

The Oakland Company have let the following contracts in connection with the erection of a residence on Bellwood Street:—masonry, B. Dougherty, 16 Cayuga Street; carpentry; W. Fryer, 5 Glen Avenue; plastering, T. Patterson, 70 Rosedale Street; heating and plumbing, J. P. Bland & Company, 775 Bank Street; electrical work, Dominion Electric Company, 417 Sparks Street.

A residence is being built for R. B. McDougall by George Eaman & Son, Isabella Street, at an estimated cost of $9,000. The contract for heating and plumbing has been let to McKinley & Northwood, 56 Rideau Street, and for electrical work to Davis Electric Company, 21 Echo Drive.

In connection with the apartments in course of erection on Metcalfe Street for J. A. MacDonald, 25 Thornton Street, the contract for plumbing has been let to M. M. O'Connell, 212 Gloucester Street, and for electrical work to Marchand & Donnelly, Sparks Street.

Quebec, Que.

The contract for carpentry in connection with the residence in course of erection for David Lacombe, 51 St. Malo Street, has been let to P. Trudel, 106 Scott Street, and for roofing to J. Maranda, 2 Grenier Street. Painting by owner.

In connection with the residence being built for G. Chamberland, 79 Napoleon Street, the carpentry contract has been let to Cote & Frere, Limoilou. Painting, heating, plumbing, and electric work will be done by the owner, and masonry by the general contractors, Poulin & Marcoux.

A. Guilmet, 204 St. Therese Street, has let the roofing, painting, plumbing, and electric contracts in connection with the erection of his residence to E. Lelievre, 1 Ste. Marguerite Street, and the plastering contract to Freres Proteau, 197½ Notre Dame des Anges Street. Painting by owner.

The general, masonry and carpentry contracts for the erection of a residence for W. Lapointe, 226 Marie De L'Incarnation Street, have been let to Bertrand & Lapointe, 1113 St. Valier Street. Estimated cost, $5,000.

In connection with the residence in course of erection for E. Thivierge, 94 St. Ambroise Street, the roofing, heating plumbing, and electric contracts have been let to E. Gauvin, 116 Fourth Street, Limoilou. Masonry and plastering will be done by the general contractor, A. Deslauriers, 100 St. Francois Street.

In connection with the residence in course of erection for J. Poulin, 160 Hermine Street, the roofing contract has been awarded to E. Falardeau, Dorchester Street, and the heating, plumbing, and electric contracts to F. Gingras, 34 St. Augustin Street. Plastering will be done by the general contractor and painting by owner.

Sudbury, Ont.

Work has been started on the erection of a residence for C. R. Smith. Practically the whole of the work will be done by the Atlas Building Company. The contract for electrical work has been let to the Cochrane Hardware Company, Cedar and Durham Streets. Approximately cost, $3,000.

Toronto, Ont.

A residence is being erected at 14 Wilfred Avenue for W. Wilkie, 10 Wilfred Avenue. The general and carpentry contracts have been let to H. W. Nix, Canada Life Building. Smaller trades will be sub-let by the general contractor. Approximate cost, $4,000.

A residence is being built at 13 Glenholme Avenue by the W. R. McGiffin Company, 1504 King Street W., at an estimated cost of $4,500. Smaller trades will be sub-let. Owner's name withheld.

Work has been commenced by H. C. Long, 901 Traders Bank Building, on the erection of a residence at 130 Keewatin Avenue, estimated to cost $5,000. The contract for masonry work has been let to Elliott & Brown, 132 Ellswirth Avenue. Smaller trades will be sub-let.

In connection with the residence being erected at 78 Glencairn Avenue by G. T. Death, 244 Sheldrake Avenue, the plastering contract has been let to F. Clark, 203 Bedford Park Avenue, the contract for painting to D. Forest, 165 Sherwood Avenue and for plumbing to A. Earl, 774 Gladstone Avenue.

In connection with the residence being erected on Conduit Street by S. B. Green, 650 Annette Street, the plumbing contract has been let to J. G. Jackson, 142 Quebec Avenue, and the contract for heating to C. C. Ormsby, 133 Quebec Avenue. Plastering, painting, and electrical work by day labor.

The plastering contract in connection with the residence in course of erection for J. J. Matheson, 1279 Dundas Street, has been let to W. A. Fenn, 203 Perth Avenue, and the contract for the installation of a special Spencer heater to McKenzie & McNaughton.

A. Hussey, 133 Sellers Street, has commenced the erection of a pair of residences at Sellers and Morrison Avenues, estimated to cost $4,000. The contract for heating has been let to G. Davis, 151 Boon Avenue. Plumbing, electrical work, and plastering will be let.

In connection with the residence being erected on Hastings Avenue by Donenfield Bros., 322 Clinton Street, the plastering contract has been let to A. J. Bottrell, 542 Palmerston Boulevard, and the heating contract to Welsh & Son, 304 Queen Street W.

The general and carpentry contracts for the erection of a residence on Melgund Road have been let to N. Hicks, 612 Delaware Avenue, and work is under way. Brick construction, shingle roofing. Approximate cost, $9,000. Owner's name withheld.

Welland, Ont.

The general contract for the erection of a residence for R. H. Dawdy has been let to Learn & Mann. Brick construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Westboro, Ont.

In connection with the residence being built on Golden Avenue by R. E. Ralphs the contract for electrical work has been let to H. L. Allan, 377 Somerset Street.

Westmount, Que.

Work is under way on the erection of a residence on Carlton Avenue for T. A. Sommerville, 49 Windsor Avenue. General contractors, B. M. Cape & Company, Limited, 10 Cathcart Street. Stone and brick construction, slate roofing. Approximate cost, $12,000.

In connection with the erection of a residence at Redfern and Westmount Avenues for J. Quinlan, 4412 St. Catherine Street, Montreal, the contract for roofing has been let to Douglas Bros., 19 St. Maurice Street, and for heating and plumbing to T. O'Connell, 183 Ottawa Street.

Winnipeg, Man.

Work has been started on the erection of two residences for R. McGreevy, 404 McGreevy Building, Portage Avenue, by L. LeDuc, 533 Sherbrooke Street. Frame construction, shingle roofing. Approximate cost, $5,400.

Power Plants, Electricity and Telephones

Fredericton, N.B.

The installation of a fire alarm system, at a cost of about $1,200, is being considered by the City Council. Chairman of the Fire Committee, T. S. Wilkinson.

Penticton, B.C.

A by-law providing for extensions to the electric lighting system has been passed, and work will start shortly. Estimated cost, $6,000. Clerk, G. S. Clark.

The Pas, Man.

The installation of a light and power system at a cost of $50,000 is being considered by the Town Council. Clerk, H. H. Elliott.

CONTRACTS AWARDED

Montreal, Que.

The contract for the installation of an electrical system at the Filtration Plant has been let by the Board of Commissioners to G. M. Gest, Power Building, at $6,275.

Rocanville, Sask.

The contract for the construction of a telephone system for the Cambridge Rural Telephone Company, Limited, has been let to Brown & McKenzie, Regina, at $3,400.

Fires

Clarkstown, Ont.

The residence of J. B. Lajoie, Cedar Street, has been destroyed by fire. Loss, $3,000, partially covered by insurance.

Niagara Falls South, Ont.

Fire has practically destroyed a dairy belonging to G.Badger, Ferry Street. Loss, about $2,500.

Smithville, Ont.

Robert E. Book's sawmill has been destroyed by fire. Loss, $5,000.

Miscellaneous

Belleville, Ont.

Quotations on the supply of cast iron pipe, chiefly 6-inch, are being received by City Engineer J. W. Evans, or the Clerk, J. W. Holmes.

Nelson, B.C.

The Town Council propose to install an incinerator at an early date. Mayor, J. J. Malone.

Tavistock, Ont.

The Town Council have instructed the Fire Committee to obtain estimates of the cost of approximately 500 feet of hose, with nozzles, etc. Chairman, H. N. Roth.

Toronto, Ont.

W. C. Collett, 7 St. Mary Street, is receiving catalogues and information with regard to cold storage and refrigeration machinery.

CONTRACTS AWARDED

Buctouche Beach, N.B.

A contract for dredging has been let by the Department of Public Works, Ottawa, to F. Michand, Buctouche.

Charlottetown, P.E.I.

The Department of Public Works, Ottawa, have let the contract for dredging at Rocky Point to W. G. W. Bertram, 117 Stair Building, Toronto.

Ottawa, Ont.

The City Council have awarded contracts for the supply of 500 feet of fire hose to each of the following firms:—Canadian Consolidated Rubber Company, 317 Bank Street Gutta Percha Company, Ottawa Dunlop Tyre & Rubber Company, 72 O'Connor Street Goodyear Tyre & Ruber Company, 184 Albert Street.

Windsor, Ont.

The City Council have let the contract for the supply of pig lead to J. T. Wing Company, 61 Sandwich StreetE., at $6.95 per ton, and for the supply of stop boxes, brass taps, etc., to the Miller Manufacturing Company, Sarnia.

Winnipeg, Man.

The general contract for the construction of five balconies for the Board of Control has been awarded to J. A. Fraser, 426 Glasgow Avenue.

When the steel passenger car was introduced into American railway systems, the immediate object was to diminish loss of life in collisions. The replacement of equipment will have cost the railways approximately $650,000,000 and incidentally has considerably increased the cost of operations, as heavier locomotives are required to haul the trains. The President of the Chicago & Great Western Railway says:—

"These heavier locomotives, with heavy steel equipment behind them, running at high speed, in case of accident become more destructive than any of the trains in the days of the wooden car; in fact, we have records of the complete destruction of steel sleeping cars in rear-end collisions, and it would be impossible to build a steel car that would resist the shock of a rear-end collision from a train running fifty or sixty miles an hour."

The substitution of steel for wooden cars has also dealt a serious blow to the lumber industries of the Pacific North-West and has increased the danger of forest fires. Car material provides a market for the common grades of lumber and the elimination of this market has meant a large proportion of waste left in the woods. Waste left in the woods means increased forest fires hazard, and greater difficulty in clearing land for agricultural development, so that in the opinion of the Pacific Coast lumberman the cost to Uncle Sam has been much more than $650,000,000—indeed, it would be more like a billion dollars—all of which has ultimately to be paid by the public.

Rough comparative costs for surface, elevated and subway lines were given recently by Prof. George F. Swain in a discussion of rapid-transit problems in cities before the Engineers' Society of Western Pennsylvania. Single-track surface line, exclusive of equipment, costs about $50,000, while the cost of a single-track elevated line, exclusive of equipment, is about $250,000. Subway costs are so variable that no accurate figures can be given; $1,000,000 per mile for single-track, exclusive of equipment and damages, or $2,000,000 per mile for double-track may, he thinks, be as fair a single figure as can be given. The figure may, however, be very misleading, he points out. The Washington Street subway in Boston, which he thinks is probably the most expensive subway in the world per mile, cost $6,916,000 per mile, including property takings, or $5,103,000 excluding them. For a single exit and entrance stairway in private property $215,000 was paid, and for another entrance to the same station an entire building was bought at a cost of $630,000, and subsequently sold for $587,500.

Within a short time the gypsum works at Quarry St. Ann's will be one of the biggest and busiest of Cape Breton concerns says the N. S. Herald. At present preparations are being perfected for the installation of a new power house, with dynamoes, air compressor, etc., which will be used in connection with the plant, and in a short time the company expect to turn out at least a million tons of gypsum a year. To-day the force of men employed amounts to about one hundred.

FOR SALE

1-10 ton Stiff Leg Derrick. Complete with Bull Ring 70 ft. mast, $350.

1 Steel Stiff Leg Derrick, 84 ft. feet Boom with 60 ft. Triangular Travelling Tower.

1 Locomotive Crane, 15-ton, 8 wheel, 50 ft. boom.. A very attractive price for quick sale.

15-25 ton dinkies, standard gauge; 28 flat cars, 60,000 lbs., want offer; 2 locomotives, 1 40-ton, 1 55-ton; 100 6-yd. cars, standard gauge; 12 4-yd. cars, 36-in. gauge; derricks, steel and wood; concrete mixers; rock crushers; motors, ¼ h.p. to 200 h.p.; transformers, hoisting engines; pumps, all sizes; 800 tons of 56-pound relaying rails; 50 tons of 20-pound relaying rails.

W. FRASER,

Dealer in all kinds of Rebuilt Equipment for Contractors

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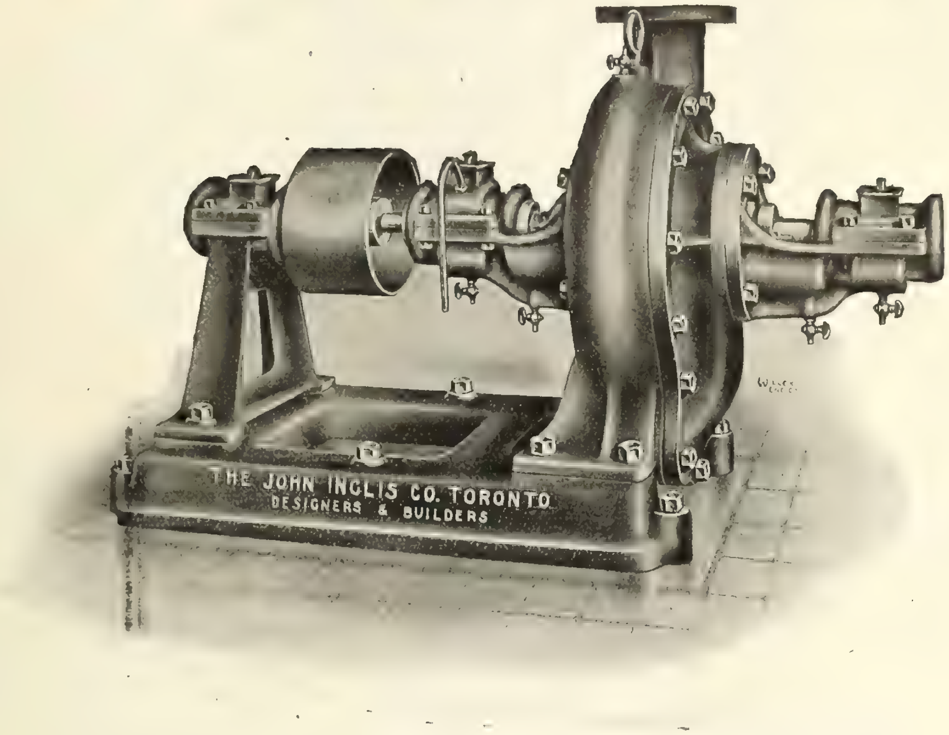
PUMPS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Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

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Montreal Office: Room 509 Canadian Express Building
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Tenders and For Sale Department

Debentures for Sale

Thirty-six Thousand Dollars ($36,000) County of Oxford "Road Improvement Debentures," to be issued June 1st, 1915; 30 equal annual instalments of principal and interest; interest at five per cent. per annum.

Sealed tenders addressed to the undersigned and marked "Tender for Debentures," will be received up till noon, **July 23rd, 1915**.

The highest or any tender not necessarily accepted.

N. E. BIRTCH, County Clerk,
Woodstock, Ont.

28

Tenders Wanted

Tenders will be received up to 6 p.m. **Saturday, July 17th**, for the construction of the substructure and superstructure of a Highway Bridge over the Madawaska River at Burnstown in the County of Renfrew, Ontario; tenders to be addressed to P. H. Bolger, Chairman Roads and Bridges Committee for the County of Renfrew, R. M. D. No. 2. Renfrew, Ontario.

Plans and specifications may be seen at the office of J. L. Morris, County Engineer, Pembroke, and J. A. Devenny, Town Clerk, Renfrew, Ont., on or about the 1st July, 1915.

The lowest or any tender not necessarily accepted.

ROBERT J. RONEY,
Clerk of the County of Renfrew.

27-28

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Monday, July 26th, 1915

for

Enlargement Manning Avenue School.

New Building, Manual Training and Domestic Science Departments, King Edward School.

Iron Fence, Iron Stairs, concrete Floors, Electrical Work, Local Telephones and Midsummer Repairs at Sundry Schools.

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall **not later than 2 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

MILES VOKES,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer

28

Notice to Contractors

SEWERS

Order No. 1004

Sealed tenders will be received, addressed to the Chairman of the Board of Works, City Buildings, St. Catharines, Ont., up to 5 o'clock p.m. of **Wednesday, July 21st, 1915**, for the construction of sewers of the following sizes:

2400	lineal feet	10-inch	Tile
1200	lineal feet	12-inch	Tile
2000	lineal feet	15-inch	Tile
1450	lineal feet	18-inch	Tile
600	lineal feet	20-inch	Tile
2400	lineal feet	24-inch	Tile

Plans, profiles and specifications may be seen at and Form of Tender obtained from the office of the City Engineer. Envelopes containing tenders **must** be plainly marked as to contents. All tenders must be accompanied by a marked cheque for five per cent. of the amount of the tender, together with the names of two personal sureties, or the name of a guarantee company approved by the City Treasurer. The lowest or any tender is not necessarily accepted.

W. P. NEAR,
City Engineer.

28

Late News Items

Bassin de Chambly Village, Que.

Tenders on the construction of sewers will be received until 7 p.m., July 26th, by the Secretary to the Municipal Council. Plans and specifications with the Engineer, J. A. Gravel, 17 Cote Place d'Armes, Montreal.

London, Ont.

The Board of Control will receive tenders until 10 a.m., July 16th, for the construction of approximately 3,500 feet of 8-inch vitrified tile sewers and 3,786 feet of private drain connections. Plans and specifications with City Engineer H. A. Brazier.

Montreal, Que.

T. Charpentier, Jr., 157 Papineau Avenue has commenced the erection of flats on Cartier Street, estimated to cost $10,000.

The sash and door factory of Z. Charbonneau, Alice Street, has been destroyed by fire. Loss, $20,000.

Work has been commenced by O. St. Denis, 969 Joliette Street, on the erection of flats on Beaulieu Street. Approximate cost, $6,000.

Montreal North, Que.

The contract for the construction of concrete sewers for the Town Council has been let to Joseph Chartier, 452 St. Andre Street, at $127,000.

Muncey, Ont.

Tenders on the erection of farm and dairy buildings at the Mount Elgin Institute are being received by Duncan C. Scott, Deputy Superintendent General of Indian Affairs, Ottawa, and will close shortly. Approximate cost, $20,000.

Quebec, Que.

In connection with the residence in course of erection for O. Parent, 103 Third Street, the carpentry contract has been let to T. Mathieu, 109 Third Street, Limoilou, and the roofing, plumbing and electrical contracts to U. Gauvin, 116 Fourth Street, Limoilou. Painting will be done by owner.

St. Catharines, Ont.

The Board of Works will receive tenders until 5 p.m., July 21st, for the construction of about 10,000 feet of tile sewers, varying in size between 10-inch and 24-inch. Plans and specifications with the Engineer, W. P. Near.

West Broughton, Que.

Fire has destroyed T. Beaudouin's sawmill. Loss, $8,000. Owner will rebuild, and will require steam power machinery.

Sanitation at Summer Resorts

The sanitation of summer resorts is a matter of supreme importance. A summer resort should be a place where people may go for rest and recreation, to store up energy for work, to live for a time in closer touch with nature, and not a place whence one returns suffering with disease contracted thereat.

In the choice of a location for the summer vacation the most important questions to be considered are good sanitary conditions and pure air, food and water.

Plenty of pure air is one of the boons of the summer resort, and every effort should be made to secure to the visitors this recreative element. The air should be fresh and free from disagreeable odours. In too many cases, especially at summer hotels or large boarding houses, the air is tainted by foul odours, sometimes the result of unsanitary conditions, as the improper disposal of waste and garbage, or of the too close proximity of stable or outside closet, while sometimes it may be caused by a stagnant pond of water or a cesspool.

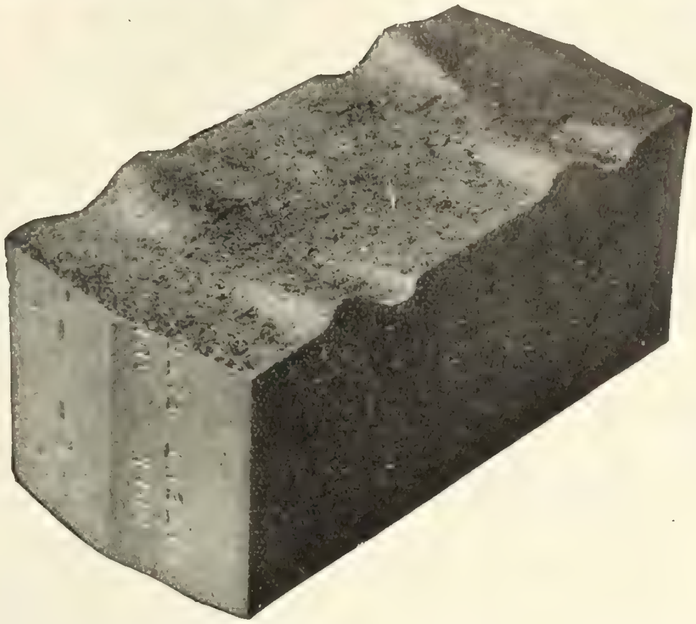
Too often also the bedrooms in these hotels are small and poorly ventilated. In any case the windows should be as large as possible, easily opened and properly screened, to prevent the entrance of flies and mosquitoes.

Summer resorts usually depend upon wells for water supply. In such places the water supply should be carefully considered, as bad water is a prolific carrier of disease. The location should be such that the natural drainage is away from the well, and should be as far as possible from closet, stable, cesspool or other contamination.

Where outside closets are used, they should be frequently cleaned and always properly deodorized by the use of lime, a solution of copperas, wood ashes or even dry earth.

Garbage should be kept in a closed fly-proof receptacle and two or three times a week it should be removed and buried at least a foot under the ground.

On account of lack of conveniences, greater care of sanitary conditions is required in the country than is usually necessary in the city. Summer visitors should, therefore, take care that their surroundings are such as will not result in their returning to their homes with the germs of typhoid to offset any advantage of the summer's change.



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Sterling Brick Company, Olean, N. Y.
Reynoldsville Brick & Tile Co., Reynoldsville, Pa.
Danville Brick Company, Danville, Ill.
Clinton Paving Brick Company, Clinton, Ind.
Alton Brick Company, Alton, Ill.
Deckman-Duty Brick Company, Cleveland, Ohio.
    Plants at Cleveland, Carrollton and Malvern, O.
Tuna Valley Pressed Brick Company, Bradford, Pa.
Foster Paving Block Company, Bradford, Pa.
    Plants at Bradford, Pa., Binghamton, N.Y., and Youngsville, Pa.
Metropolitan Paving Brick Company, Canton, Ohio.
    Four plants at Canton, O., one at Willow, O.
Bessemer Limestone Company, Youngstown, Ohio.
    Three plants at Bessemer, Pa.
Peebles Paving Brick Company, Portsmouth, Ohio.
    Two plants at Portsmouth, Ohio, one at Firebrick, Ky.
Murphysboro Paving Brick Co., Murphysboro, Ill.
Southern Clay Mfg. Company, Chattanooga, Tenn.
    Plants at Robbins, Tenn., Coaldale, Ala.
McAvoy Vitrified Brick Company, Philadelphia, Pa.
    Plant at Perkiomen Junction, Pa.
Windsor Brick Company, Akron, Ohio.
Hocking Valley Brick Company, Columbus, Ohio.
    Plant at Logan, Ohio.
Veedersburg Paver Company, Veedersburg, Ind.
Springfield Paving Brick Company, Springfield, Ill.
Terre Haute Vitrified Brick Co., Terre Haute, Ind.
Albion Vitrified Brick Co., Albion, Ill.
Alliance Clay Product Company, Alliance, Ohio.
Westport Paving Brick Company, Baltimore, Md.
Mack Manufacturing Company, New Cumberland, W.Va.
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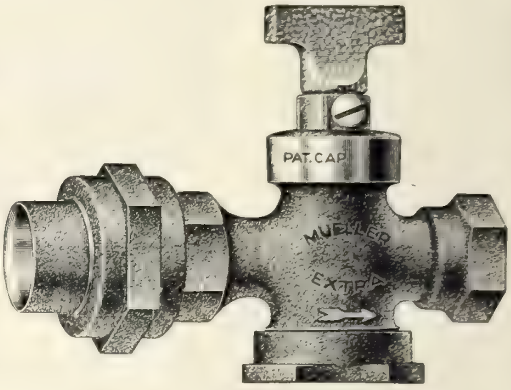
Patent Cap Lead Flange
Curb Cock



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This No. 86 Inverted Key pattern of the lead flange type of curb cocks is a splendid representative of Mueller Quality products. It is a staunch, dependable article—good metal, fine workmanship and good service-giving qualities. You can't beat it. Users of Mueller Goods are insured against defects by our 200 pound hydraulic pressure test.

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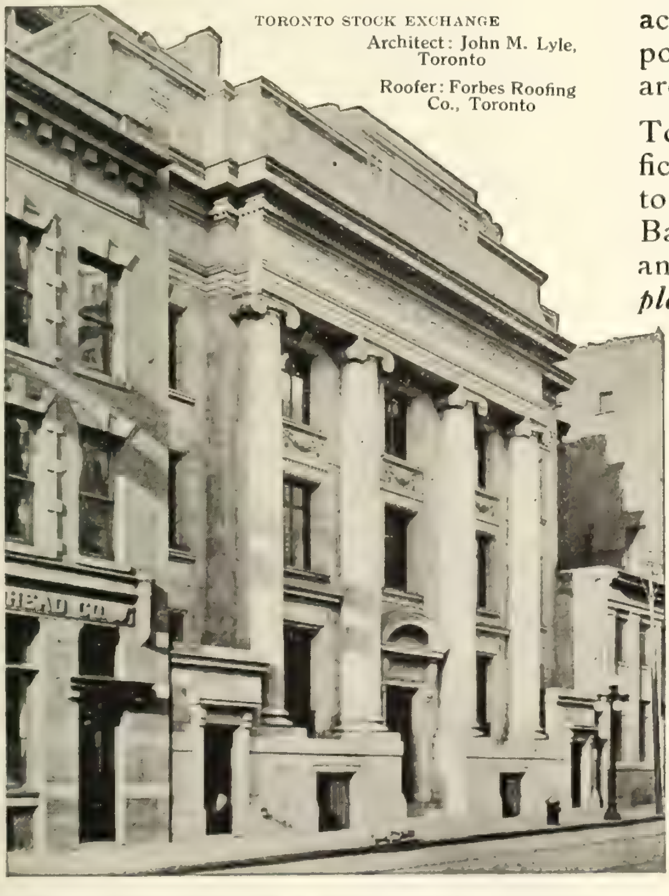
It is a bit unusual, perhaps, to find that the cheapest permanent roof to build is also the ***best*** roof—yet that is the case with Barrett Specification Roofs. Their low cost and long life account for their high standing and popularity with first class engineers, architects and roofers.

To be sure of getting a Barrett Specification Roof on your building send to our nearest office for a copy of The Barrett Specification with diagrams and ***incorporate same in your building plans.***



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Architect: John M. Lyle, Toronto
Roofer: Forbes Roofing Co., Toronto

Special Note

We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired, however, the following is suggested:

ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified and subject to the inspection requirement.

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The following Books are Offered subject to Previous Sale:

British & Foreign Building Stones, by John Watson, Published in 1911 at the University Press, Cambridge, England. 483 pages. Price 50 cents.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

Contract Record
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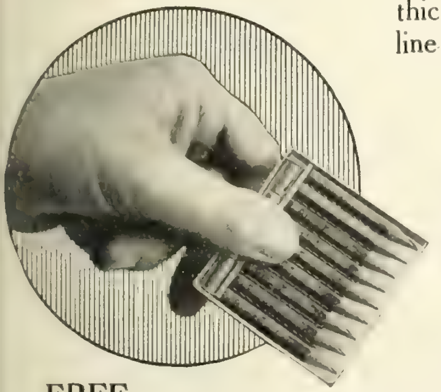

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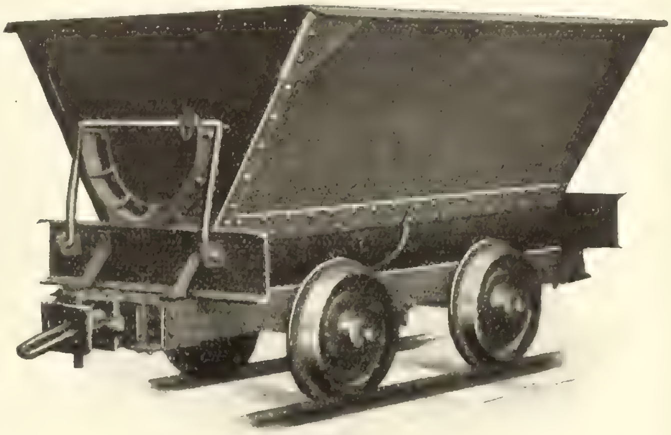

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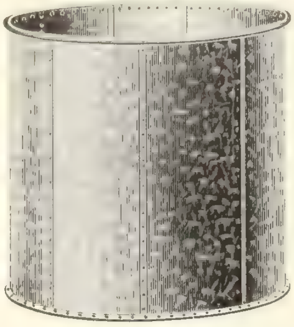

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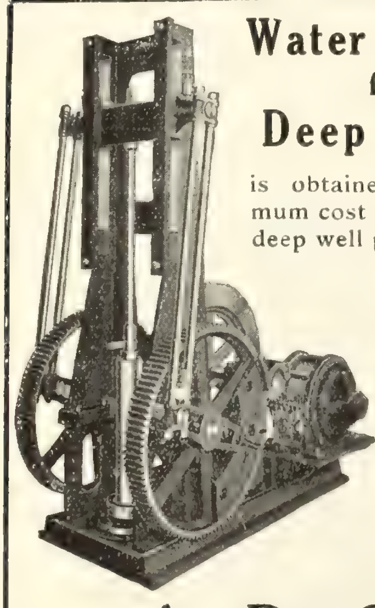

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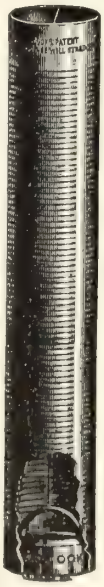

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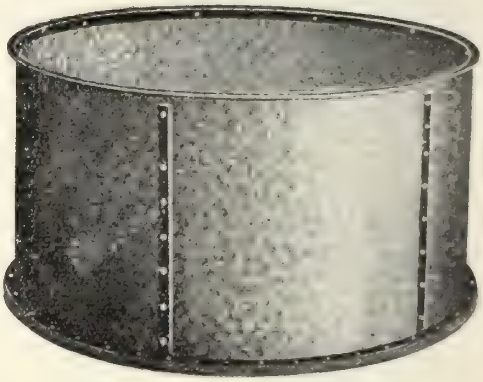

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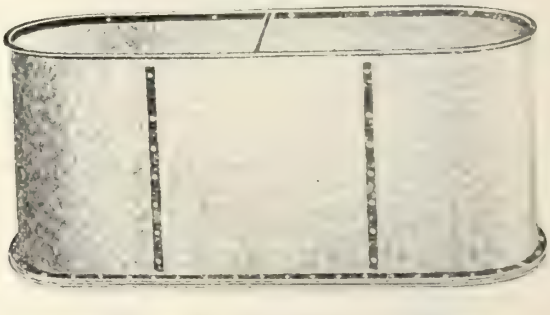
This is our most popular tank and is in great demand by contractors and builders. It is made of No. 20 gauge galvanized iron and is reinforced with heavy 1/4 inch iron strips, making it exceptionally strong and rigid.



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This round end tank is preferred by some as it is more adaptable for many purposes. Same construction and material as No. 51 above.

We also manufacture Plain Galvanized Iron, Corrugated Iron, Metal Sidings, Ventilators, Sky Lights, etc.

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G. W. Essery, Manager

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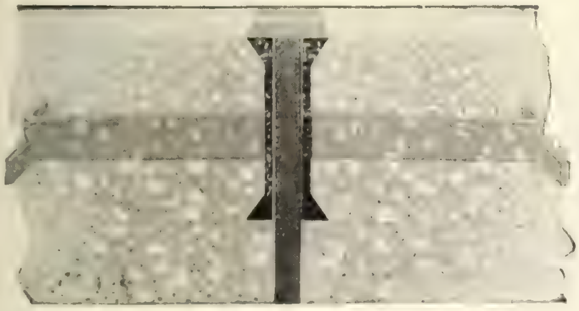
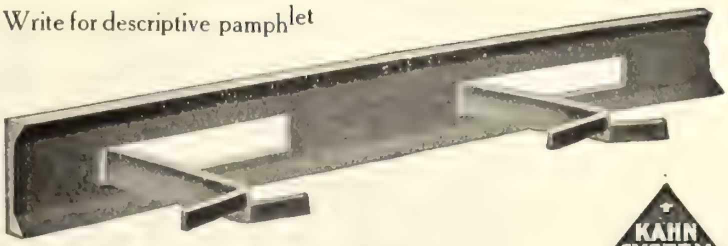
1182 Broadway, New York.

KAHN ARMOR PLATES for CONCRETE ROADS



[illegible] showing joint protected by Kahn Armor Plates with filler between them.

Write for descriptive pamphlet



Kahn Armor Plate.

KAHN SYSTEM Building Products

The Beveled Edge Protects the Concrete

TRUSSED CONCRETE STEEL CO. OF CANADA, LIMITED, Walkerville, Ont.

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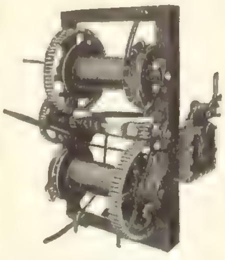
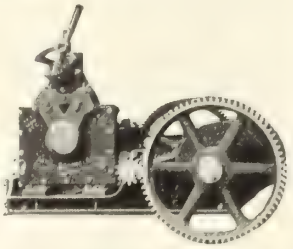

Motor Crab

Write for catalog and prices

Dake Engine Co.

Grand Haven, Mich.


Swinging Engine

Sand, Gravel and Crushed Stone

Lime
Cement
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Our prices are right and our service good.

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Ornamental Lighting Poles

During the past few months we have supplied ornamental lighting standards for the following places:—

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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

William Hamilton Company

Peterborough, Ontario

The contract for the new Half Million Dollar Civic Library at Montreal has been awarded in

"Queenston Blue" Limestone

Specify and get the best Canadian Stone.

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NATIONAL IRON WORKS, Limited

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every size for Water, Gas, Culvert or Sewer, Carried in Stock at

Lake or Rail Shipments TORONTO and PORT ARTHUR

Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

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Send for catalogue and prices

Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

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Get the Name in Your Town as the right man for

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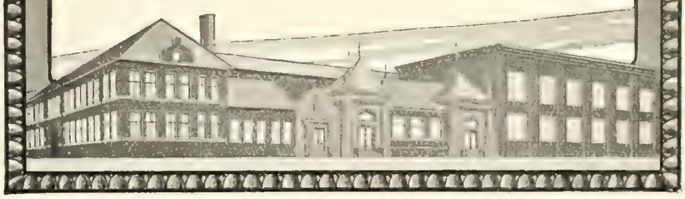
Write us for samples to show your customers and up-to-date advertising matter to mail to the dozens of prospects in your vicinity. Our plates fit snug and right—you get a good job quickly! That means profit and reputation.

Write us today for catalogue and prices.

Metallic Roofing Co., Ltd.

Toronto Manufacturers Winnipeg



Neptune Meter Co.

Manufacturers of the well-known

TRIDENT Frost-Proof Water Meters

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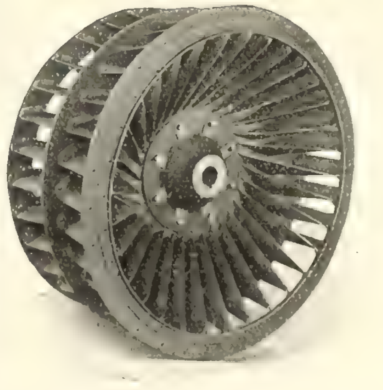
Main Office - 90 West Street

NEW YORK CITY

Keith Fans



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SHELDONS LIMITED, Galt., Ont.

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Messrs. ROBERT HAMILTON & CO., LTD., Bank of Ottawa Bldg., Vancouver, B. C.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12 in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.75; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. net cash. Copper bearing sheets—Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13½c basis; African hemp, 13½c; sisal rope, 10½c basis; lath yarn, 9¼c. Boiled linseed oil—in barrels, 80c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20. Bags 10 cents extra.

Lime—Grey, 34 cents per bushel; white, 32 cents Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No 2 red pine, 4 and 6 in., $46; No. 3, $40; No 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots. f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY

LIMITED

BAR STEEL

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"Pillar Brand"

The Best Gypsum Products

"Pillar Brand" Gypsum Products are made from the highest grade Nova Scotia Rock. Every barrel and bag of "Pillar Brand" products are inspected and tested before shipping. They include

Hardwall Plaster **Cement Plaster** **Land Plaster**
Whitewall Finish **Plaster of Paris**

"Pillar Brand" Hardwall Plaster is mixed only with the highest grade of goat and cattle hair, thoroughly washed and specially prepared. If you need high grade gypsum products—get prices on "Pillar Brand".

Write us.

The Iona Gypsum Co., Limited

Head Office, Sydney, N. S. *Mills,* Iona, N. S.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page (66) ·

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $11.50 per 100 lbs.; boiled linseed oil, in bbls., 98 cents per gal.; raw linseed oil, in bbls., 95 cents per gal.; dry red lead, $10.00 per 100 lbs.; putty in bulk, $3.25 per bbl.; putty in 25-lb. tins, $3.75; turpentine, in bbls., 80 cents per gal. Mixed paint, ordinary colors, per gal., $3.10.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 350 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35 in car lots, $40 in warehouse; fire clay, $12 per ton in car lots.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galavanized iron—28 gauge, $5.75 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

STANDARD ROOFINGS

When you cover a farm, factory or railroad building with NEPONSET Roofings you know that you will get satisfaction.

We absolutely stand behind our roofing materials.

NEPONSET PAROID ROOFING

is one of the best known of our brands. It is however only one of a large line. We also make NEPONSET Wall board, the most practical substitute for laths and plaster that has ever been put on the market. It is made in several finishes and its surfaces have been waterproofed so that it is all ready to apply, and needs no further decoration.

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Hamilton, Ont.

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BIRD NEPONSET PRODUCTS

Bird & Son, Hamilton, Ont.

Montreal St. John Winnipeg
Calgary Vancouver

Burlington Steel Co.

(Formerly Canada Steel Co., Ltd.) Limited

Hamilton, Canada

STEEL BARS

for Reinforcing Concrete

Rounds, Squares, Flats, Twisted Squares, Angles, T-Bars,
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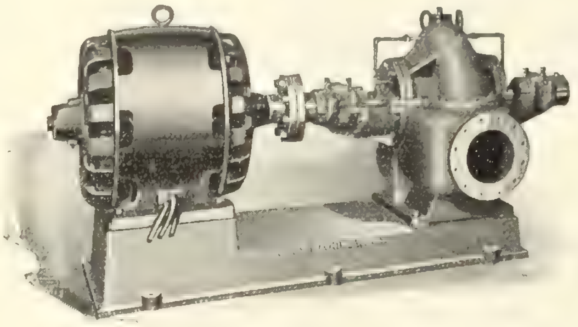

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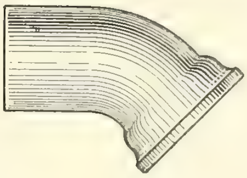

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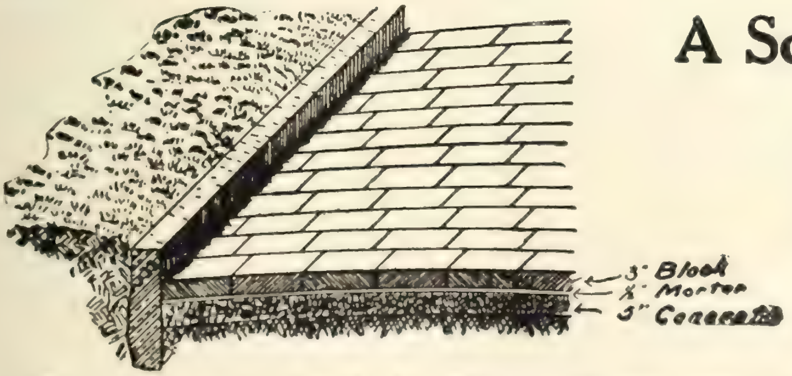

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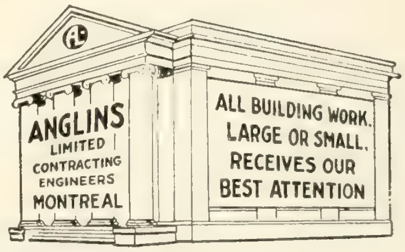

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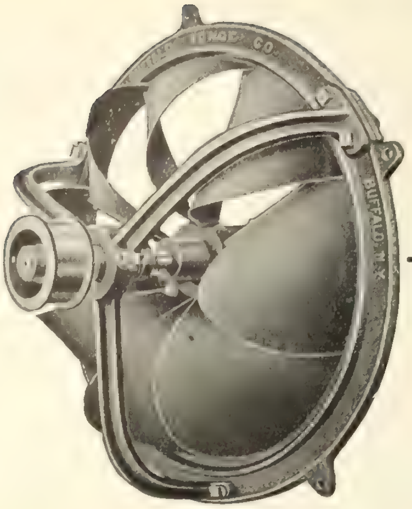

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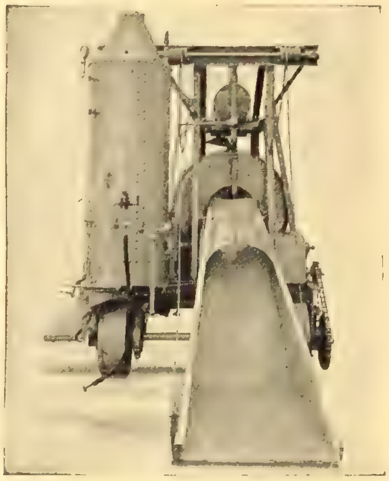

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We will be pleased to submit designs of a plant to take care of your special requirements if you will send full particulars relative to the work to be undertaken.

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Saves Cement that is ordinarily lost.

From one to two barrels of cement is saved out of every thousand bags.

When you return bags only partially cleaned, you not only lose the cement but pay freight on it as well.

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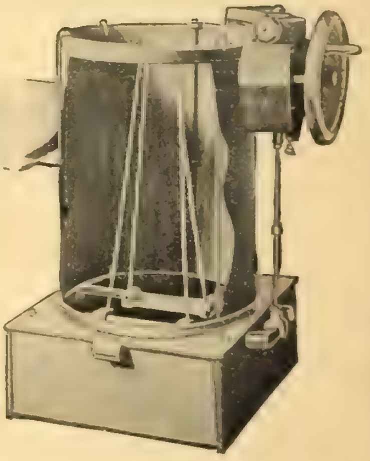

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Vol. 29 Toronto, July 21, 1915 No. 29

Contract Record and Engineering Review

ESTABLISHED 1886

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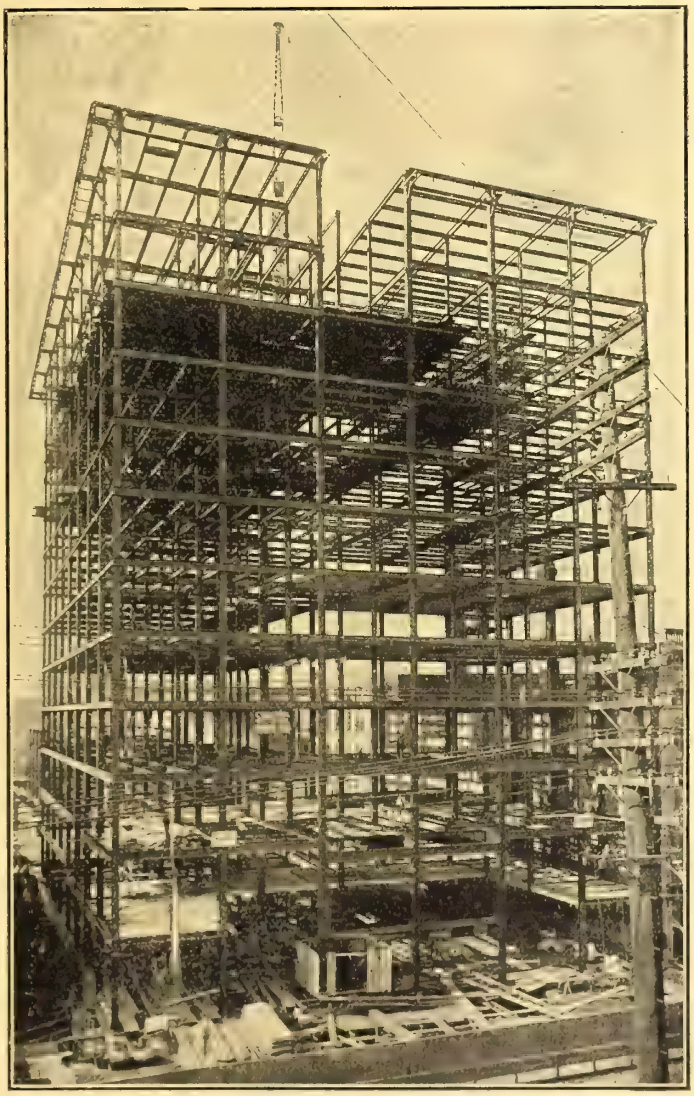

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For Every Purpose

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Send us your enquiries.

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Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements Page 6

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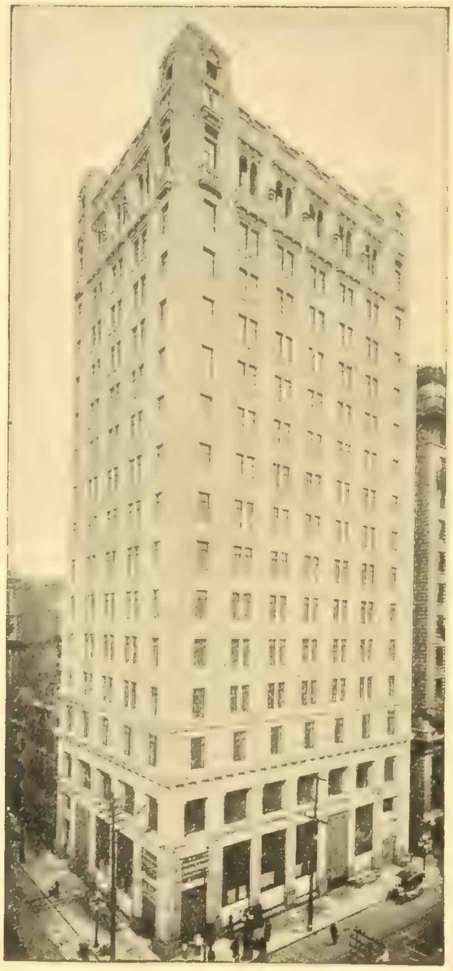

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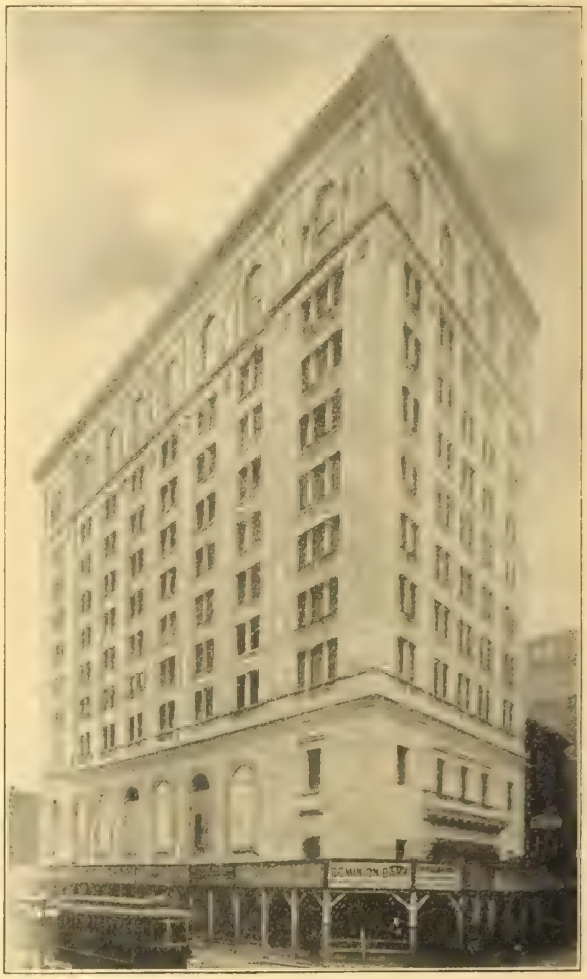

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Throughout Canada

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Tomorrow Or the day after you’ll get this information free of all cost to you, and without the slightest obligation on your part. All that we ask is that you will seriously and thoughtfully look into our claims.

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Exhaust Heads
Canadian Blower and Forge Co
Sheldons Limited

Engines
Canadian Blower and Forge Co
Can. Fairbanks-Morse Compan
Hopkins & Co., F. H.
Inglis Company, John
Laurie & Lamb
McDougall Caledonian Iron Wks
Rock & Power Machinery Co.

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Bowman & Connor
Cape Company, E. G. M.
Chipman & Power
Dominion Engineering & Inspection Company
Farmer, John T.
Galt Engineering Co., John
R. S. & W. S. Lea.
McDougall, Geo. K.

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Pedlar People Limited
Trussed Concrete Steel Co.

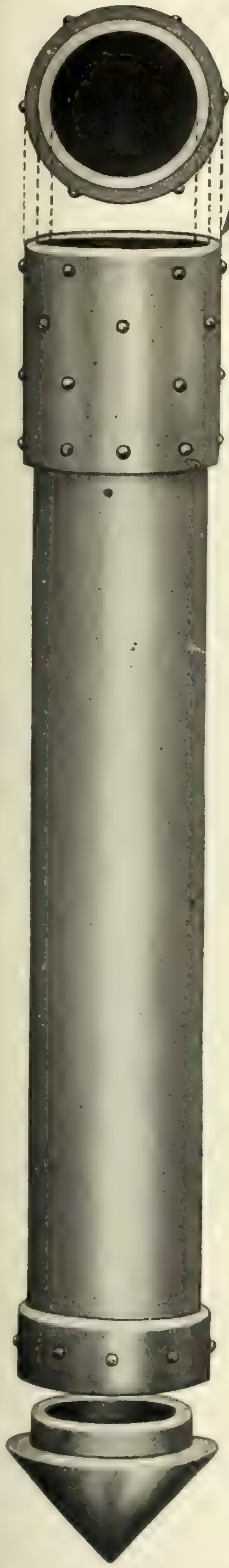
Fans
Sheldons Limited
Sturtevant Co. of Can., Ltd., B. F

Fire Hose
Can. Consolidated Rubber Co

Filtration Plants
verMehr Engineering Co., John

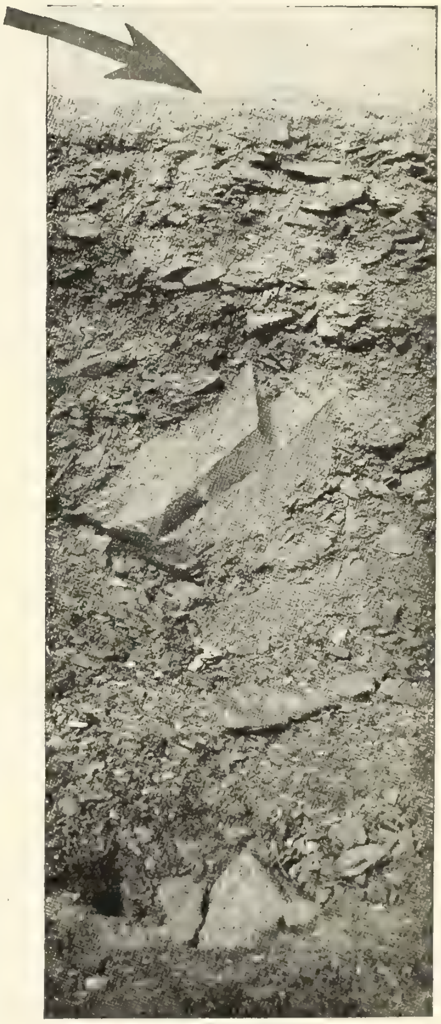
Fireproof Doors and Windows
Hope & Sons, Henry
Ormsby Company, A. B.
Pedlar People Limited
Steel & Radiation Limited
Trussed Concrete Steel Co

(Continued on page 12)



Why SIMPLEX Goes Through

Ground Like This



This is not a fanciful picture of what might be—it is a photographic reproduction of the red shale through which 800 Simplex Piles were put down 35 feet to solid rock.

This was possible because the 16-in. diameter Simplex steel driving form is ¾ in. thick, and stands up under the terrific impact of a 3,000 lb. drop hammer, going down until it gets to bed rock or good footing.

The SIMPLEX Form Drives Fast

When the concrete has been poured into the form, and the form pulled, the Simplex Pile cements itself firmly to the surrounding ground, filling every crevice and developing immense frictional support. Though the solid concrete columns rest firmly on bed rock, or into hard pan, this ideal skin friction gives great additional bearing power. That is why fewer Simplex Piles are needed for a given loading—the first substantial SIMPLEX saving.

A single system of putting in Concrete Piles (which cannot be varied) no matter how good it may be, is not always the most suitable for every kind of ground. Therefore we have developed three kinds of Simplex Piles: the STANDARD SIMPLEX, for foundations, in-fills and the ordinary unreliable ground; the MOLDED-INSERTED SIMPLEX for very soft and peaty conditions, and the COMPOSITE for jobs in which a very deep penetration is wanted.

Write for the fully illustrated book on SIMPLEX Concrete Piling.

Simplex Concrete Piling Company of Philadelphia

Canadian Representatives

Simplex Construction Company, Limited

Coristine Building, MONTREAL

"Simplex Piles Drive to Firm Footing"

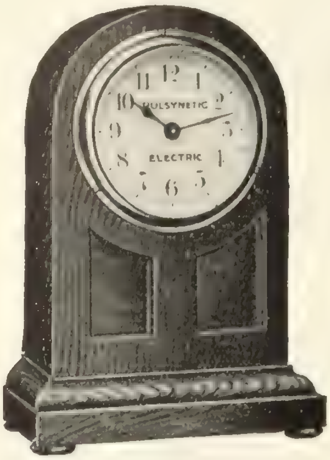


Fig. C 21. Mantel Clock

ARTISTIC MERIT

as well as accuracy in Time-keeping is embodied in all Pulsynetic Electric Clocks. No matter whether they are to be fixed in the Residence, Office, Factory, Warehouse, or Tower, we have the correct design at the right price.

One master transmitter controls any number of dials, irrespective of size or position and never wants winding.

Architects, Engineers and all interested in Correct Time should send at once for our Book Five, or full particulars and prices may be obtained from:—

W. Ashall
442 Sherbourne St.
TORONTO

Gent & Co., Ltd.
Leicester, Eng.

Cables, Lodestone

KERR

Gate Valves

and

Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

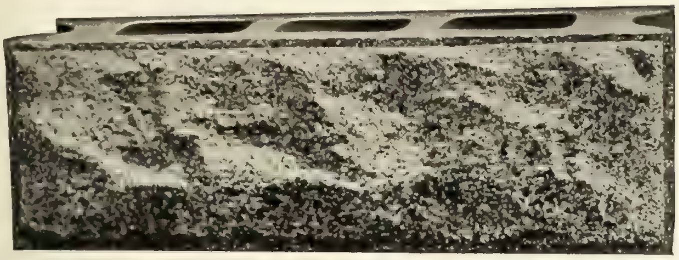
Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO



8 x 8 x 24 inch Granite Rock Face Block

Molds for Casting

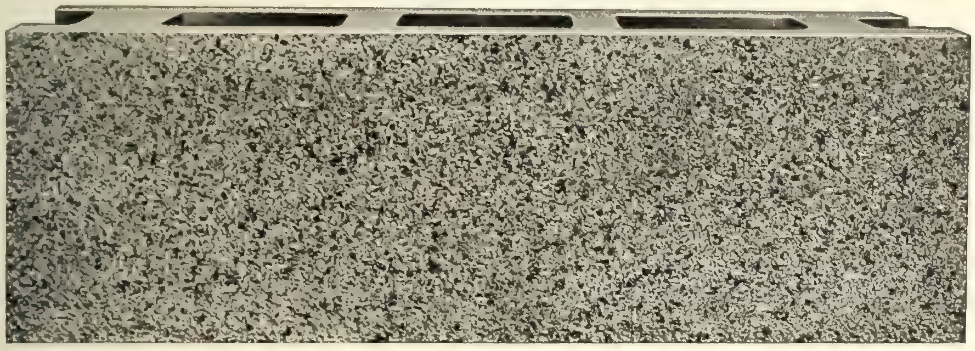
Waterproof Hollow Cement Building Blocks

With Granite Faces

THEY COST LESS — THEY SELL FOR MORE

YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited **(Zagelmeyer System)**

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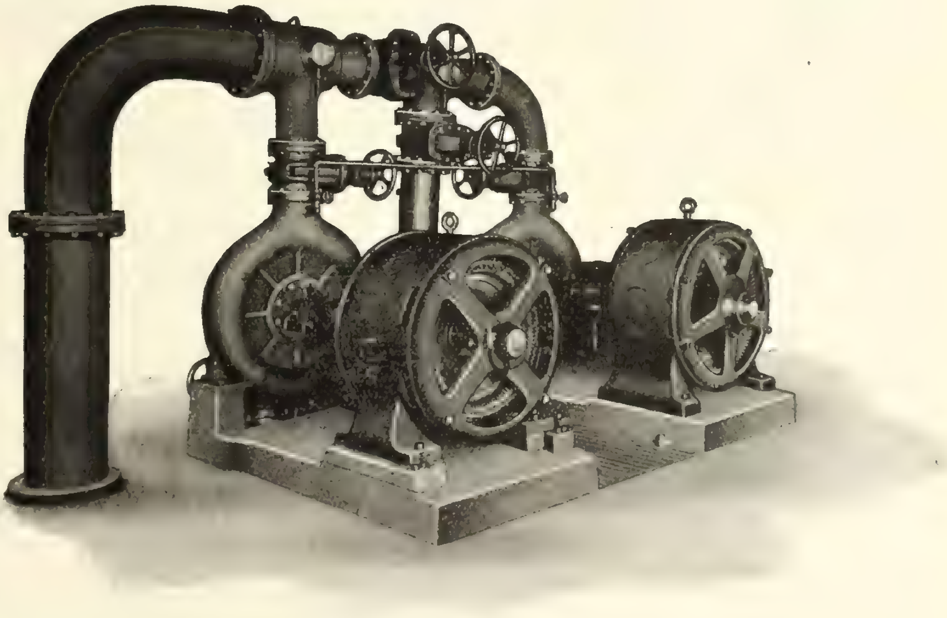
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

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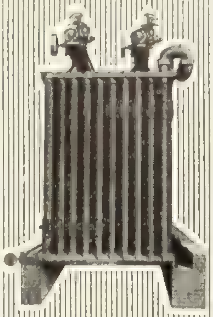
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

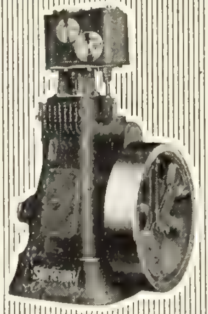
Sturtevant

Trade Mark



Economizers

Motors



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Fans

MADE IN CANADA

The Growth of a Great Industry

Back in the early sixties our business in fans and blowers was firmly established but no suitable drivers were available—no engine of the period came up to requirements. Accordingly there was developed a complete line of steam engines—sturdy, well-designed and perfectly lubricated. These engines found early application in naval service where requirements are exceedingly severe. The fact that they proved so successful is a sufficient guarantee of their excellence. Later, motors and turbines were developed as high speed fans came into general use.

We thus have a complete line of fans and prime movers and can deal efficiently with all air-handling problems—no matter what the conditions of speed or pressure.

The designs of all our prime movers—engines, turbines and motors—have been worked out with special reference to their application to fans and blowers. For such service they are unquestionably superior.

The addition of fuel economizers to our line of power apparatus enables us to render complete and efficient service in power house economy.

Bulletins are published on all our apparatus. Copies sent on request.

B. F. Sturtevant Company of Canada, Limited

GALT, ONTARIO, CANADA

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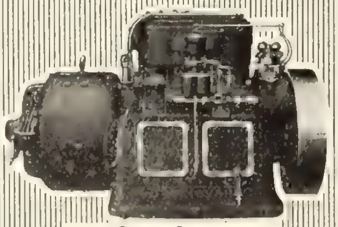
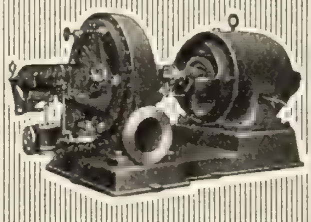
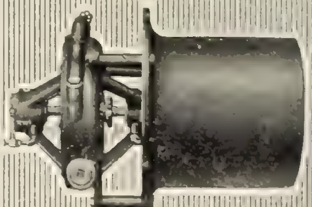
Selling Agents Sanford Riley Stoker Co., Limited
"THE RILEY STOKER"



Gasolene Generating Set



Turbo Generator



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Brick, Stone, Cement and Concrete Surfaces

(except floors) can be preserved and beautified, and given a pleasing, uniform appearance, by the application of the Toch Brothers'

"LIQUID KONKERIT"

A Liquid Cement Paint in colors for Interior and Exterior use.

This material not only decorates, but preserves and weather-proofs, the surface to which it is applied, and eliminates that coarse, dirty, ugly appearance so common to ordinary re-inforced concrete work. Saltpeter will not come to the surface of walls treated with "Liquid Konkerit."

Light wells, passage ways, interiors of factories—

wherever the maximum of light is required--should be coated with "Liquid Konkerit Primer" followed by a finish coat of White "Liquid Konkerit" or Flex-Sicco ready mixed paint.

"Liquid Konkerit" is supplied in seven standard shades, besides white, but can be made in any desired color on special order.

The new "Liquid Konkerit" booklet thoroughly describes this material and shows the attractive shades in which it is supplied. May we send you a copy?

Manufactured in Canada by

"R. I. W." DAMP-RESISTING PAINT CO. 202 Mail Bldg., TORONTO
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Dartnell, Limited, Montreal
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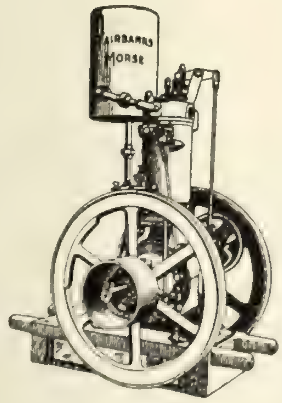
A Big Reduction in Prices on F-M Industrial Engines



An opportunity to secure at an extraordinary low price a sturdy, serviceable gasoline engine that can be used for pumping, hoisting, running concrete mixers, air compressors and the many other jobs familiar to engineers.

3 H.P. F-M was $175 now $135
4 H.P. F-M " 200 " 165
6 H.P. F-M " 285 " 236

All prices strictly net f.o.b. factory, Toronto.

These prices include only those engines now in stock and will be accepted for a limited time only. If you want any special size not listed above, let us know at once. It is quite likely that we can supply you. All F-M engines are fully guaranteed.

These engines are all evaporator cooled with make and break ignition. They may be supplied with wood or iron base.

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Canada's Departmental House for Mechanical Goods

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Morris Hoist & Crane Co., Herbert.
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Pawling & Harnischfeger

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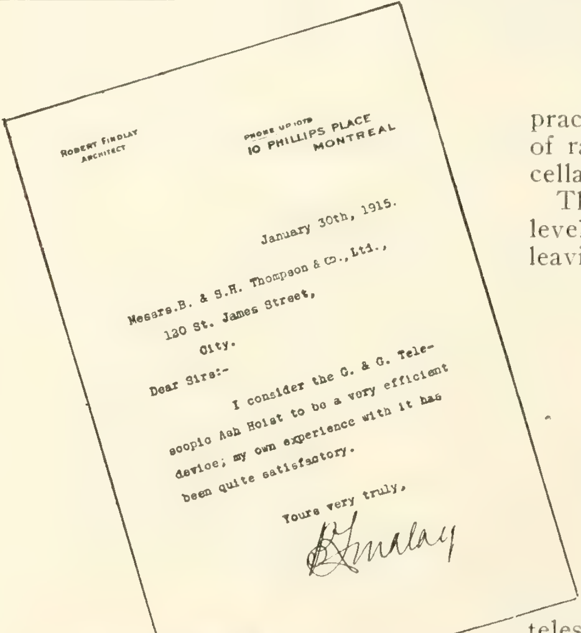
ROBERT FINDLAY
ARCHITECT

PHONE UP 1079
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Messrs.B. & S.H. Thompson & Co., Ltd.,
130 St. James Street,
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I consider the G. & G. Telescopic Ash Hoist to be a very efficient device; my own experience with it has been quite satisfactory.

Yours very truly,

BFindlay

Robert Findlay, Arch.

A "One-Man" Ash Hoist

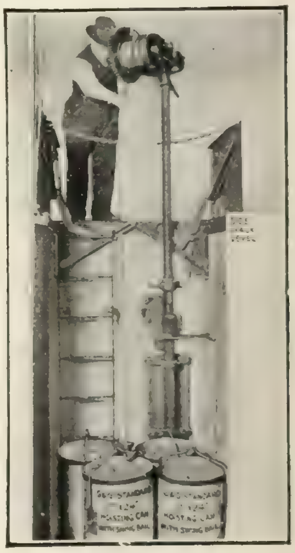
The G & G Telescopic Hoist is so designed that it is practical for one man unaided to perform the entire operation of raising ash cans to sidewalk and lowering empty cans to cellar.

The operator standing at sidewalk level can raise 4 or 5 cans without leaving the sidewalk.

The G&G PATENTED Telescopic Hoist with compound gear and brake attachment

Raises a maximum load of 500 lbs. at a guaranteed speed of 30 feet per minute.

When not in use, hoist telescopes and no part shows above street level. This hoist is fitted with a patented "silencer," making it absolutely noiseless in operation. It can be installed in any building, old or new.



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STREET SPRINKLERS

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Send for Bulletin.

Capacity

350 Imperial Gallons
500 Imperial Gallons
600 Imperial Gallons
750 Imperial Gallons

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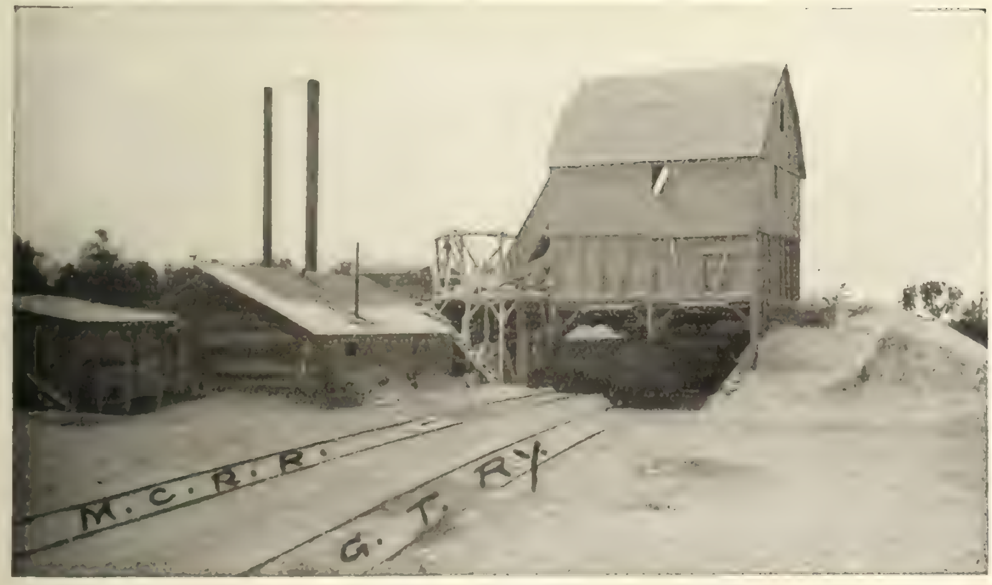
A Full and Complete Line of Road, Street and Contractors' Machinery.

Manufactured by

THE DOMINION ROAD MACHINERY CO., LIMITED, Goderich, Ont.

Macadam Roads



must be built of a

Tough Stone

that will cement

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Hagersville - Ont.

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ARTIFICIAL MARBLE is polished (not varnished) in the same manner and with the same material as natural marble.

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We manufacture ARTIFICIAL MARBLE in all the beautiful colorings of the Itàlian, Greek, French and Belgian marbles, and the well known Canadian and American marbles, and our facilities are adequate to turn out the largest contracts.

Specify ARTIFICIAL MARBLE and avoid delays caused by the unsoundness of natural marble quarries.

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J. E. CARREAU

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CRUSHED STONE

Good Roads Making Good
by using

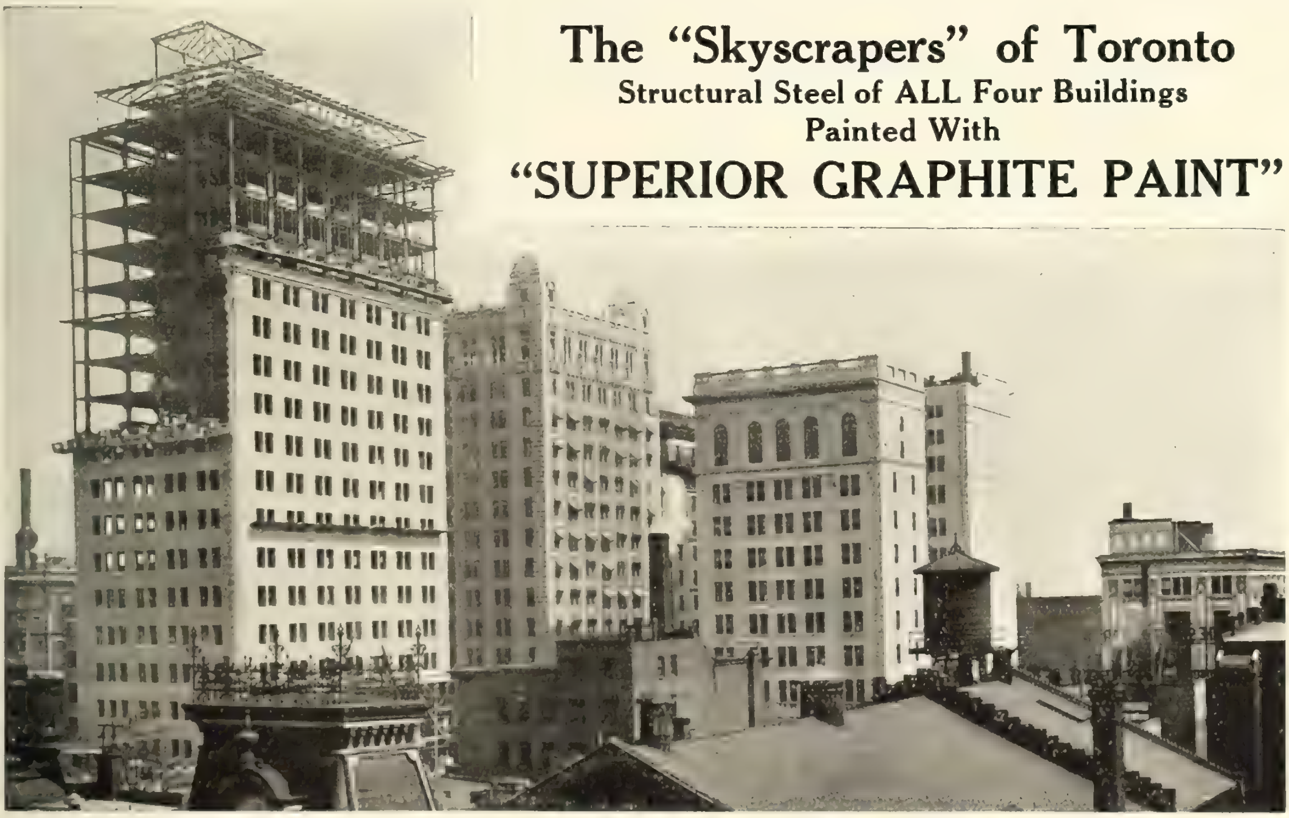
Dundas Stone

Best by Test

Canada Crushed Stone Corporation, Limited
DUNDAS, ONTARIO

Toronto Agents:—Rogers Supply Co., Limited, 38 King Street West

The "Skyscrapers" of Toronto
Structural Steel of ALL Four Buildings
Painted With
"SUPERIOR GRAPHITE PAINT"



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Toronto
Montreal

Made by—DOMINION PAINT WORKS, LIMITED
WALKERVILLE, ONT.

Winnipeg
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  - Pittsburgh Valve, Foundry and Construction Company
  - Sheldons Limited
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- **Steam Turbines**
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  - Hopkins & Co., F. H.
  - Steel & Radiation, Ltd.
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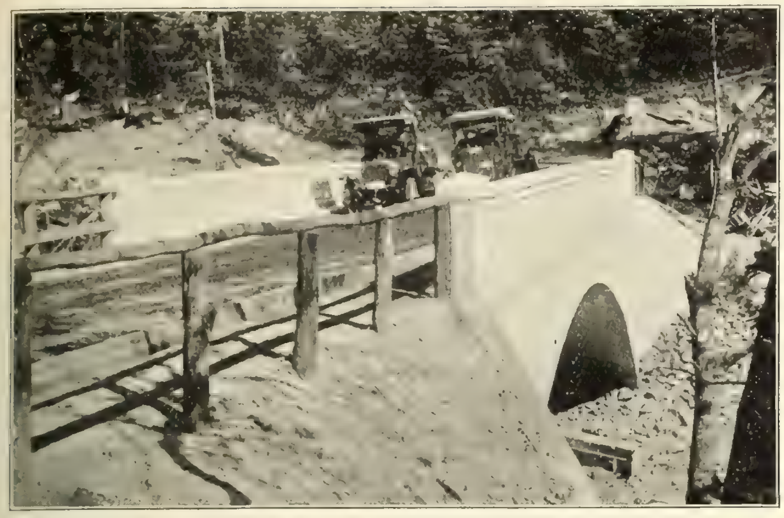

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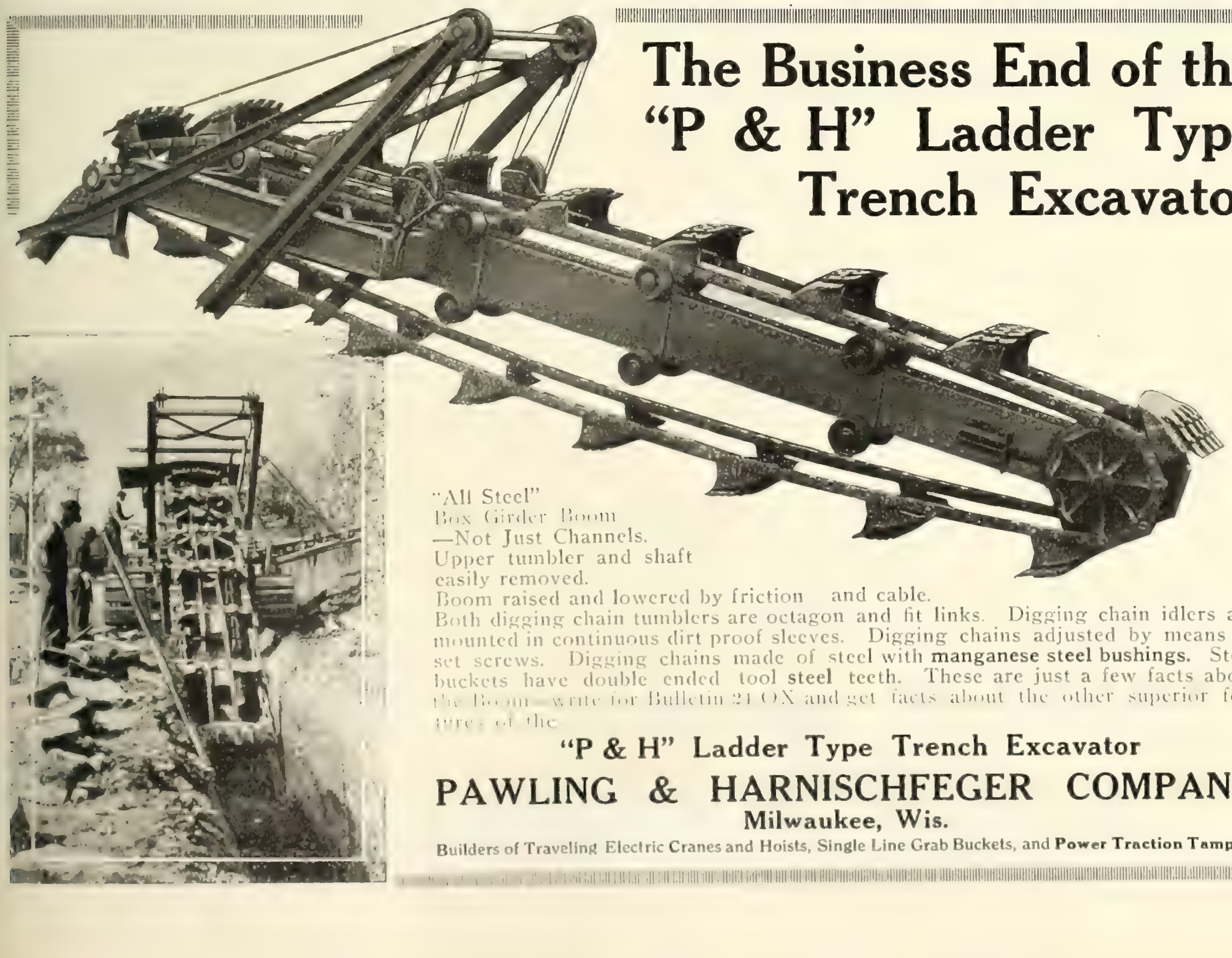

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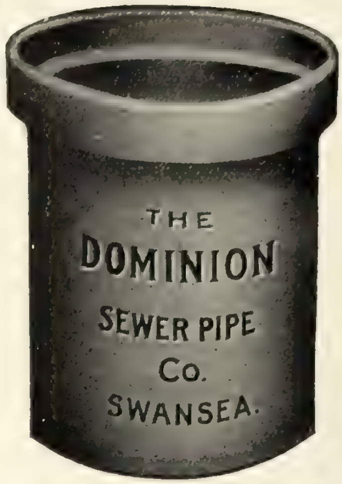

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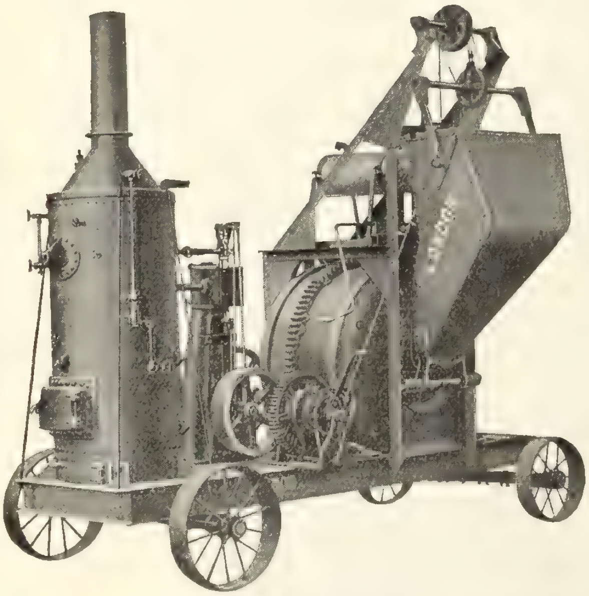

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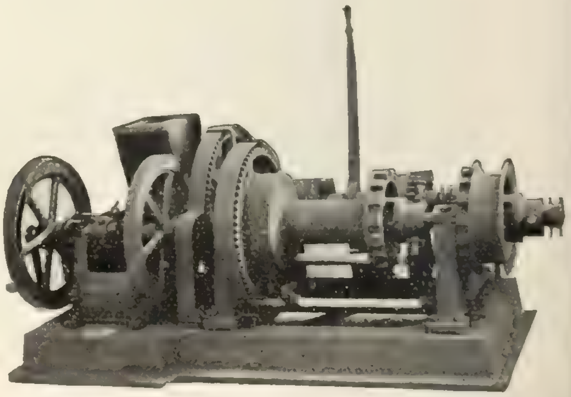

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Business Managers for Councils

We had thought that the sphere of city managers, efficiency experts, and other specialists, was essentially American, but from what we can learn there would appear to be the possibility of a field opening up across the water. At any rate, we find one of our English contemporaries suggesting that the affairs of the county councils be administered or supervised by a "Business Manager." It is argued that in large commercial undertakings there is always an official of sufficient training and breadth of experience to detect, almost by intuition, any leakage, and advise means whereby the utmost efficiency may be obtained at the least possible expenditure. Why not a business manager for a county council? Councils, we are told, are but the parallel of boards of directors, controlling vast concerns in which the shareholders are represented by the ratepayers. It is suggested that at their head there should be a trained and experienced business man to superintend all departments, to master every detail, examine each financial proposal, and check each transaction. Our contemporary continues:

"The regular staff would soon feel that they also were concerned in the task of making the business pay, and would loyally assist in checking waste. It is by such means that our gigantic commercial businesses are made to pay big dividends, and the salary of such an official would soon be paid out of the money saved. Moreover, the effects of this system of thrift would be cumulative. The presence of this business adviser would curb the competitive instincts of councillors and strengthen the hands of the other officials, many of whom are forced by existing circumstances into extravagances which their private judgment condemns."

The suggestion is well enough in theory, and the observations are very beautiful in their way. To the Canadian mind there is something very attractive in the picture of a staff all working together to make the city's business pay, and loyally assisting in checking waste, but these attractive propositions do not always work out just right. In the first place, where is one to find a man sufficiently versatile and able to control all the various activities of a town, city, or county council? In all conscience, it is hard enough for a technical man to please the public in his capacity as city engineer, when he can take refuge in the theories and formulas appertaining to his work. The lot of the business manager, were a man of sufficient competence to be found, would not be an enviable one.

Then, surely, it would be difficult to define the beginning and the ending of the functions of such an official. Again, the engineering activities of his Board would be one of the most important in his province, and to detect "leakages" in the City Engineer's department "almost by intuition" he would have to possess technical training of no mean calibre.

As to "curbing the competitive instincts of councils," we cannot believe that under the existing system, whereby men of such low attainment are elected to administrative office, this could be accomplished by any adviser—business or spiritual.

If we were to offer any advice to our friends across the water, who would appear to be influenced by the developments of recent years in the United States, we might compress it into one word—the word that sums up Mr. Punch's sentiments in respect to matrimony—"don't." The simpler the system of administration, the better—and in most cases the older systems are the simpler, because they were devised at a time when business conditions were not so complex, and when men talked less and thought more, perhaps.

Innovations of this kind which have been made in the United States have not been attended by any remarkable degree of success, and with all due respect to the characteristic enterprise of the adherents of Uncle Sam, business administration across the border generally is not such as to provide the material for a volume of correspondence, with all the specialized departments which have come into being.

Efficient administration rests with the public: they decide at the polls how their affairs are to be carried out. If we can raise the standard of admission to our councils it will not be necessary to cast about for new offices, to employ experts to detect "leakages," and check inefficiency.

We are sorry to find our English friends talking of business managers for their councils. It is an unhealthy sign.

The War—A Forecast and a Warning

(From The London Builder)

THOUGH it may be long before the war is over, we have confidence enough to believe it can only have one outcome, and, though any forecast of its consequences may not be fully borne out by results, yet it may be useful to consider the changes which are likely to be effected and their result on the industry of building.

The great family of European states, with the exception of Germany and Austria, or possibly Germany alone, ardently desired peace last year, and did all that could be done to secure it. France, though ever conscious of the amputation which resulted from the war of '70, would never have drawn the sword in aggression to recover her lost provinces, while neither England nor Russia had anything to gain from war commensurate with the certain loss of life and treasure involved in prosecuting it. The Allies drew the sword unwillingly, only to find themselves confronted with an organized force of aggression such as the world has never seen, and to realize that the motto "Duetschland uber alles" represented not a legend but the passionate conviction of a whole people. But now that the issue has been forced peace can only come through the loss by Germany of much that has made her in the past the most powerful single state in Europe, and this loss will cripple her and put an end to the commercial supremacy which she has gained during forty years of enormous commercial expansion.

The direct outcome of this state must be an increase in the manufacturing and commercial developments of other countries, notably England, France, and America, and the increase, which will be not only relative but actual, will bring other consequences in its train.

There can be little doubt that we shall see building developments at first checked by the dislocation caused by the war and the resulting dearness of money, but ultimately gathering force and resulting in a period of increased production and manufacturing activity. We may, therefore, enter on a second phase of industrial development, which, owing to our Factory Acts and other legislation, will not be detrimental to the health and physique of the people like that of the earlier part of last century.

To an extent unknown at any previous period capital is likely to be invested freely where it will earn the best dividends, for there will be little likelihood for a long time of war and the rumours of war which so often check the free flow of capital.

The conditions which have made for cheap production in Germany will, to a large extent, have vanished, since the markets of the world are not likely to be as freely open to her as in the past, while her capital will have been greatly dissipated in war. There is naturally another side of the question, for the partial destruction of Germany as a seller will destroy her potentiality as a buyer; but this will injure manufacturing interests in other countries less, because she has always been a large buyer of raw and partially manufactured goods and a large seller of highly-finished products.

While the expenditure of capital on war by this country and the Allied powers will prove an immense drain, the interest of which must for long be a burden, there will be counterbalancing advantages which will, as time goes on, make themselves felt. The cost of preparation for war is largely occasioned by its likelihood or imminence. The German naval programmes for many years have determined our own; the German army increases have been counterbalanced by increases in the armed forces of France and Russia. So that, although the abolition of force is a chimerical dream, we may look forward to decreased expenditure in preparation for war when the European boundaries are remodelled in accordance with racial lines. More than this, the nations who have faced a common danger will be bound by ties which will tend to eliminate the artificial barriers which have operated in the direction of hampering trade. The development of the Balkan States and the new solidarity given to the Empire will operate in favour of producing new markets and encouraging commerce.

Housing conditions will naturally be affected by the loss of a certain percentage of the population; since housing is urgently required not so much because it is inadequate in amount, but because the existing accommodation does not meet the hygienic standards of the time, and so the pressing need for it will remain, and if the private speculator has been frightened by the recent land legislation it will still have to be undertaken by municipal and county authorities. The present coalition of parties may perhaps bear fruit in the future settlement of some controversial points on broader lines, and it may be possible that a modus vivendi may yet be found on the question of land which will remove the present feeling of insecurity in it as an investment.

Less money will be spent for some time on municipal schemes other than those which are urgently required, as the average ratepayer will feel the greater necessity of keeping down rates because of the raised standard of national taxation.

The wealthy will, as they have done in the past, spend money on building, and the advisability of renting or owning houses will not be affected, since we are forced to rent or build under any circumstances, but there may be for some time a larger demand for smaller houses owing to the necessity of many to economize.

Summing up, we should say that there will be an increase of purely commercial and utilitarian building, a temporary decrease of municipal building, other than that of a purely utilitarian character, and a normal amount of private work of a domestic character. When we couple with this the fact that a great deal of work, the execution of which has been delayed owing to the war, will be put in hand, we should be safe in predicting a period of great building activity within a short period of the conclusion of peace.

We might add that as in the opinion of most experts there is likely to be an increase in the cost of building after the war, it would probably be a prudent course for those who are able to do so to build now rather than later. The industry will also be helped if those bodies and private individuals who know they will have to build in the near future would make all preparations for doing so by having professional work done now. By so doing they will be saving time and also performing a public service, as, if everything is left undone till the war is over, it will tend to promote a period of unemployment after the return of our armed forces, and labour will have to wait until these preparations are made, while there is now ample time to get all in readiness.

There is one factor which may militate against this result, and, in fact, militate against a great trade revival and throw the commercial advantages accruing from the cessation of war into the lap of our rivals—we refer to the possibility of great labour troubles. We knew a boy who was more noted for bodily than mental vigour, and who, when he found a gold watch would not go, proceeded to wash it with a nail-brush, and the process of striking has always seemed to us as reasonable a remedy for labour disputes and as creditable to both employers and employed. Obviously labour and capital have something to divide, which is the profit on a transaction, and it should be possible to agree as to the division without resort to strikes; and the only way to effect this is for capital and labour in each industry to settle on some kind of a sliding scale, and last but not least for labour to honour its cheques.

For the building trades or any other industries to create labour troubles when the revival comes is to play into the hands of our rivals and check commercial prosperity.

Without being Socialists we can sympathize with the efforts of those who are to obtain for the people a larger share of the good things of this life; but Socialism, if it ever comes, will not be brought about by a revolution, but by the gradual transfer of profits to the labour side of the account, the capitalist becoming the titular instead of the real ruler of the world of enterprise. Education and permeation are necessary if this is to come about, and the strengthening of the weakest links of the human chain, not the tearing apart of the strongest ones. In a world of free trade an undue advance of wages in Europe will throw men out of employment here and transfer industries to the more primitive countries of the East, to the workers' detriment. The cotton looms of India may in the future convert free trade Manchester into a protectionist centre, or, on the other hand, transfer an industry from West to East, unless the Asiatic worker has as high a standard of wages and material comforts as our own. If the gospel of Socialism is right it will prevail in the end, but undue insistence on its rights in any circumscribed area will simply transfer trade to more primitive communities. Labour will always gain an advance in times of great prosperity that it will never wholly lose in the slumps which follow, and in its own interest should do nothing to check that prosperity which is automatically working in its favour and giving it year by year greater powers and influence in the counsels of the State.

Another factor which may prove to be important is the fact that many of those taken from sedentary occupations and now under arms will be disinclined to take up their former employment. This may result in greater emigration to the dominions beyond the seas, and a further strengthening of the ties which bind us to those of our race who are daily giving us proof that the Empire is one in spirit and that the strongest of states may rest on a foundation of the freest of institutions.

Engineering Prospects and Opportunities*

By F. H. Fay

THE future of engineering is bright. Opportunities are expanding. The world is coming to expect and to demand a higher standard of the engineer and of engineering. Engineering is the oldest of all professions, and dates from the earliest and most elementary civilization; but it is only within comparatively recent years that it has become recognized as a distinct profession, and we must still look to the future for that full recognition to which we engineers believe the profession is entitled.

In every field of activity the world is coming more and more to depend and rely upon engineers. But to meet these demands, engineers themselves must grow and become broader men. The successful engineer of to-day and of to-morrow cannot be like the engineer of yesterday, who too often would "retire into the technical recesses of his professional work and content himself with being the servant of other men." The engineer of to-day should be a broad-gauge man, aggressive, alert, in touch with public questions outside his own narrow field, and a leader—not a follower—of men. It is upon the development of the qualities in engineers themselves that the whole future success of the profession depends.

The best technical school training for an engineer is one which gives a thorough grounding in the fundamental subjects of science and engineering without frills and specialties. In response to popular demand, there has been in most of our technical schools during the past few years a tendency to too high a degree of specialization. Fortunately, a reaction is setting in, and in the best technical schools to-day courses are being rearranged so as to give the student a more thorough training in science and the general principles of engineering, with less specialization.

There is one quality of highest importance to the success of the young engineer which cannot be taught in schools and which he must gain for himself, and that is, the ability to properly meet and mingle with his fellow-men. In other words, he should be what is popularly known as a "mixer," and failure in this direction is responsible for the lack of, or limited, success, of many an engineer who has the other requisites, and who but for this lack would undoubtedly achieve a far higher position.

The engineer should be a manager, and should give orders to others who can do the work under his direction as well as he himself could do it with the situation reversed. It should not be considered unprofessional for an engineer to be a capitalist ,and, when he takes his proper place as promoter and organizer and shares in the profits of engineering enterprises, he will no longer be taunted with the saying that "an engineer is only good to spend other people's money." It is by acquiring individual strength that the engineer can give strength to the profession. It is well known that engineers of admitted proficiency often have to work under the direction of men who are unfitted by education and experience to direct engineering work. This is because the engineer is a workman, while the other party belongs to the class of "managers." The engineer has not reached his proper rank until he can hold the position of manager, as well as that of a designer and supervisor of work.

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*Extract from the Presidential address before the Boston Society of Civil Engineers at the recent annual meeting.

Engineers themselves are frequently responsible for the low estimate which the public places upon the value of engineering services. Chief engineers of Corporations and Public Boards too often make the mistake of hiring engineering assistants at the lowest possible wage, under the false impression that by such rigid economy they are enhancing their own value in the minds of their employers.

Such practices do grave injury to the whole profession and cheapen it in the estimation of the public. Furthermore, they tend to react to the disadvantage even of the chief engineer, for his employers will reason that if the rank and file of engineers can be hired so cheaply, engineers as a whole are a cheap lot, and high salaries are not necessary in any grade, even that of the chief engineer himself. The chief engineer who pays a fair wage, taking account of the time and money which the young engineer has spent in securing his education and training (his working capital), will not only secure better, more loyal, and more efficient service, but will help to raise the standard of the whole profession.

Modern Tendencies in Railway Track Construction

Specially contributed by J. L. Busfield, B. Sc.*

IN reviewing modern railway track construction it is natural to make a comparison with track construction as it was, say, twenty or thirty years ago. The first impression is that there has been remarkably little change, as the rails are of essentially similar shape, are fastened to the ties in the same way, and so on. But a closer study of the question reveals the fact that there have been very considerable changes, although they are of such a nature that they are not at once apparent. It was only in the early eighties that open hearth steel was used generally for the rails; previous to this date wrought iron was commonly used. The rails were made by passing a number of strips of iron through rolls at white heat welding them together. A great deal of trouble was experienced with this method due to the rails splitting along the line of the laminations. At this time a rail section of about 56 or 60 lbs. to a yard was commonly used, and the maximum size reached was 70 lbs. to a yard. These rails conformed approximately to the shape of rail now used. Thirty years ago a split switch was not used to any extent at all, the now abandoned stub switch being in universal use. Spring frogs were used occasionally, but in a very crude form compared with present-day practice.

Ballast

A large proportion of railroad track is ballasted with whatever material, more or less suitable, can be obtained readily in the immediate neighborhood. In this way such materials as dirt, cinders, burnt clay, furnace slag, and gravel are commonly used. Of these gravel is the best and most popular material, and is readily obtainable in natural deposits in all parts of

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* Assistant Engineer, Montreal Tunnel and Terminal Construction.

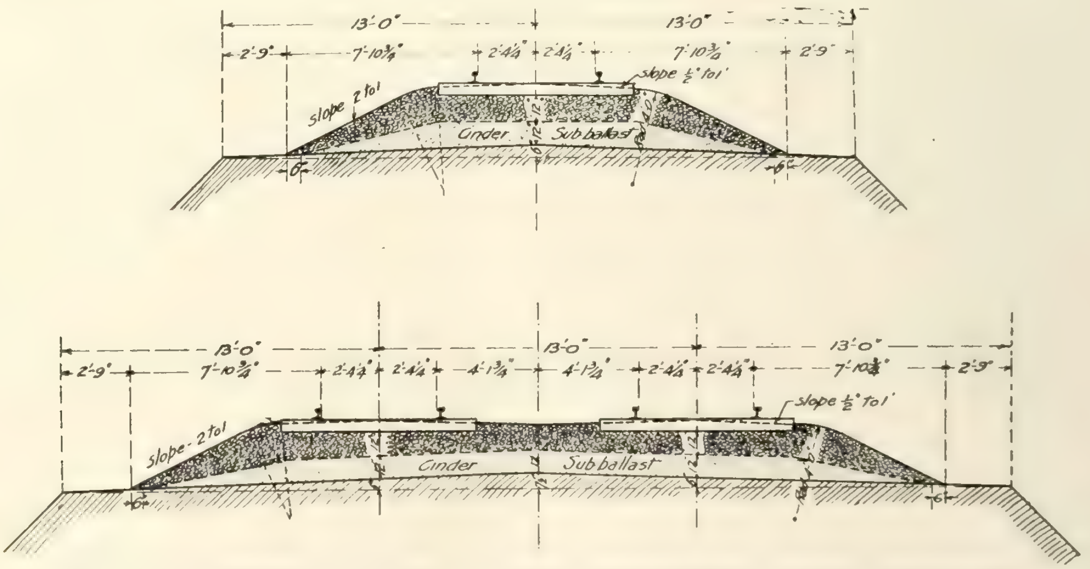


Fig. 1.—Typical roadbed sections as approved by the American Railway Engineering Association for Class A tracks.

the country. An improvement of the natural material is frequently made at no very great expense by screening and washing, removing such objectionable features as fine sand, dirt, dust, marl, lime, etc. A great objection to gravel ballast is that it is apt to be dirty, and it does not shed water very freely—with the result that in freezing weather it expands, and generally upsets the line and surface of the track.

Where conditions necessitate a first-class track regardless of the initial expense, crushed rock (broken stone) ballast is the only material that really fulfils all the requirements of a good ballast. Considering that different rocks have very variable quantities, care has to be taken to select a good kind of rock, suitable for the purpose, and, bearing in mind that rock ballast will cost from $3,000 to $6,000 for every mile of double track, it will be seen that a certain amount of study is warranted to ensure the selection of a rock that will be suitable. It is impossible to name any particular variety of rock as being more suitable than others, because all rocks vary in their properties in different localities; for example, the commonest rock used for ballast is limestone, but there are some kinds of limestone most unsuitable for ballast.

In order to obtain the best results, rock for ballast should have the following properties:—First: It should break with a sharp angular fracture and not into thin shaly pieces, so that the sharp points can grip the ties and prevent their displacement, and at the same time provide interstices between adjacent stones, enabling drainage water to percolate freely. Second: The rock should have a high specific gravity in order to minimize any tendency to displacement. Third: The rock should be both hard and tough—the former, to resist grinding action and the formation of dust, which would block the interstices between the stones—and the latter, to resist fracture by impact. Fourth: Its water absorption factor should be low, as a rock that will absorb much water rapidly becomes disintegrated under the action of the weather. Fifth: Its cementing value should be low; otherwise the fine grindings will bind the whole roadbed into such a solid mass that detrimental results will be obtained in the line and surface of the track.

It has not been the general practice in the past for railways to prepare specifications covering all these points, but in some cases a statement is made that stone for ballast must withstand a certain minimum crushing load (usually from about 10,000 to 12,000 lbs.), and also that the rock shall be durable enough to withstand climatic effects, hard enough to prevent pulverizing under the action of tools or traffic, and that it shall break with an angular fracture when crushed. Sizes are usually specified, but these vary considerably on different roads. The U. S. Department of Agriculture have established tests and standards covering all the features mentioned above, but the figures obtained have not yet been adopted to any extent by the railways.

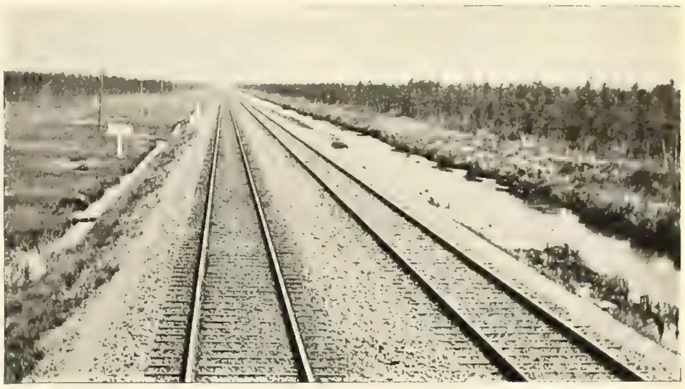


Fig. 2.—A piece of double track in which Carnegie steel ties are used.

A recent innovation in roadbed construction is the use of a sub-ballast, which provides an additional drainage medium between the ballast and the roadbed. It should be formed of sand, stone screenings, cinders, granulated slag, or any convenient material that will drain readily and at the same time fulfil the functions of a cushion. Typical roadbed sections as

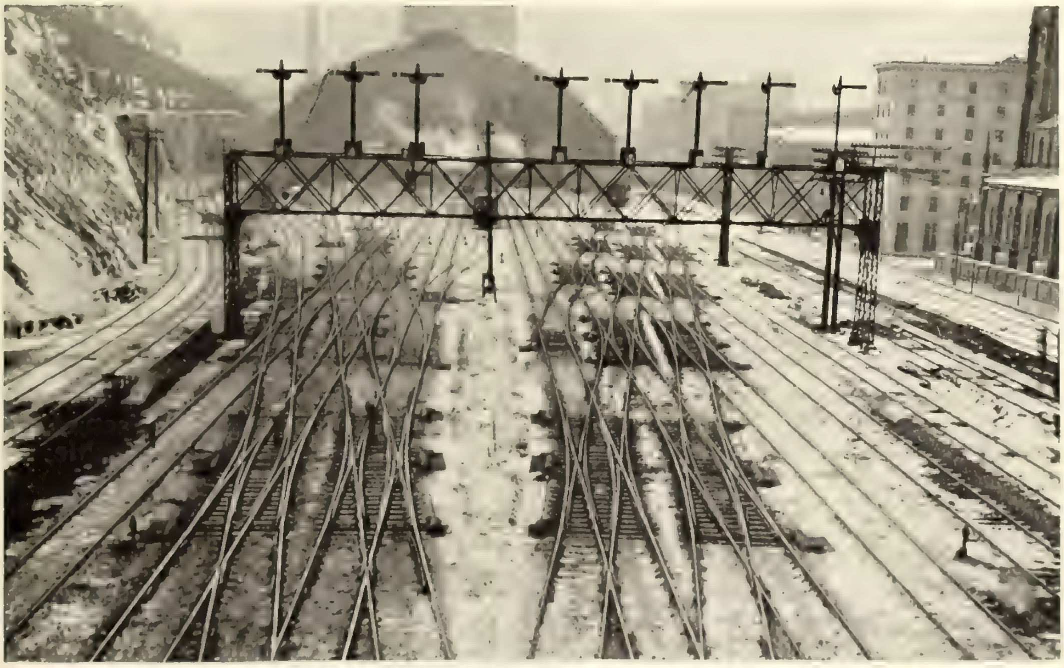


Fig. 3.—A typical instance of the use of slip switch crossings.

approved by the American Railway Engineering Association for Class A tracks are shown in Fig. 1.

Cross-ties

With increased wheel loads and higher train speeds, the cross-tie has to be particularly well selected in order to withstand the strains placed upon it. Originally the railway tie was taken from the most available supply, whereas to-day it is common practice in Canadian railways to import long-leaf yellow pine ties from as far as the Southern States. The desirable properties of the ideal wood for a cross-tie are heaviness, hardness, strength, toughness, elasticity, and durability, and there are very few woods which fill all these requirements. The woods most nearly forming an ideal tie are long-leaf yellow pine, white oak, and eucalyptus, but a very large number of other woods are in general use. It frequently happens that when a tie is particularly durable it is apt to be weak. This applies in the case of a cedar tie. Cedar is very durable, but it is readily damaged by rail cutting. This difficulty, however, can be overcome by the use of tie-plates which spread the rail load over a large area of the tie. Because of the growing scarcity of trees suitable for supplying ties, a number of railways in the States have inaugurated their own plantations for supplying ties. In these instances the eucalyptus, locust, and catalpa trees have been most favored on account of their rapid growth. They all make first-class ties.

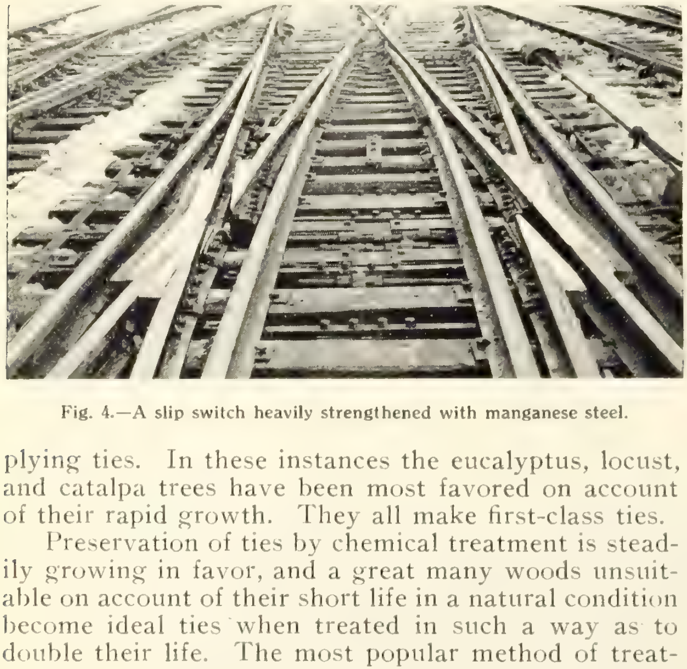


Fig. 4.—A slip switch heavily strengthened with manganese steel.

Preservation of ties by chemical treatment is steadily growing in favor, and a great many woods unsuitable on account of their short life in a natural condition become ideal ties when treated in such a way as to double their life. The most popular method of treatment is some form or other of the creosote process, but there are a large number of adherents to the zinc chloride and other processes using the two chemicals as a preservative medium.

On account of the growing cost of wooden ties, with the added cost of treatment and the use of tie-plates, the use of the steel ties is becoming quite a standard practice. There are two forms in common use: (1) the inverted channel section; (2) the I-beam section. The first of these is a standard on the National Railways of Mexico, and has proved very successful, but is far outnumbered in point of use by the Carnegie steel tie. This latter is a steel I-beam of special section rolled in different weights and sizes to suit varying conditions of traffic. The rails are fastened to the tie by means of a steel clip and a small bolt, four of which are used to a tie. Where electric track circuits are in use some insulating medium is placed between the rail and the tie. The weights most commonly used are 20 and 28 lbs. to a foot, and these ties are 5½ ins. and 6½ ins. high, with bases 8 ins. and 10 ins. wide, and tops 4½ ins. and 5 ins. wide respectively. The ties are usually cut 8 ft. 6 ins. long, and are spaced 18 to 20 ties to a 33-ft. rail. There is no question but that they form a very satisfactory tie, and their use depends more on financial consideration than on their efficiency, although quite a favorable comparison can be made between the steel tie and a first-class oak tie, creosoted and fitted with screw spike and tie-plates, provided the life of each type is taken into consideration. Figure 2 illustrates a piece of double track where Carnegie steel ties are in use, and the popularity of this form of tie is proved by the fact that there are now in use upwards of 5,000,000 steel ties.

A certain amount of experimenting has been done with concrete ties, but so far there is no particular type which has been used to any extent, and they have not advanced beyond the experimental stage.

Track Fastenings

With the growing cost of ties every effort is made to increase the life of a tie to the maximum amount possible. It has been found that the life of a tie is to a great extent limited by its inability to resist the mechanical wear caused by rail and spike cutting, so that as it becomes more common to treat ties with a preservative it is more essential that they should be protected from mechanical wear. To this end tie-plates and screw spikes have come into general use. The former increase the area upon which the load is applied to the tie, thus reducing the tendency of the rail to cut into the tie, and the latter penetrate the wood without damaging the fibres to such an extent as the cut spikes. In the case of a screw spike the tie is usually bored before being placed in the track, and if the tie is to be treated this is an additional advantage, as it allows the preservative to reach the innermost part of the tie at the point where it is most needed. Screw spikes are somewhat more expensive than cut spikes, both in manufacture and installation, but once installed they need less attention than cut spikes. Having a holding over twice that of the cut spikes, and also a greater lateral resistance, they are able to keep the track to better line and gauge. Wherever the nature and volume of traffic requires an absolutely first-class track cut spikes are being generally displaced by screw spikes.

Rails

Although there has been no very great departure from the general use of standard open hearth or bessemer steel rails, there is a growing demand for a rail to be used under special conditions where the wear is exceptionally heavy. To meet this demand the attention of railway engineers and rail manufacturers is being given to two points—namely, the use of rails of larger section, or of harder steel. The maximum rail section in general use at the present day is one of the different forms of 100-lb. rail, but studies are being made in the design and manufacture of rails up to as high as 140 lbs. to a yard. Difficulties are encountered in the manufacture of a rail of this size, particularly with regard to obtaining the best quality of steel in the head.

A great deal of experimenting has been done with special alloy steels, such as manganese, titanium, nickel, and silicon. A difficulty encountered, however, in steels of this nature is that, although they are extremely hard and wear well, they have not the ductility of an open hearth steel, with the result that fractures are apt to occur frequently. It is rather an unfortunate condition that the heaviest wear on rails, naturally occurring at approaches to terminals, frequently occurs in tunnels and where electric traction is employed. It has been found that the life of a rail in a tunnel is only about half of what it would be under the same traffic conditions in the open, and it is also found that the type of electric equipment generally used decreases the life of an ordinary rail, partly by corrugation, and partly from other causes. Multiple-unit cars as used in subways are probably the worst offenders in this respect. In cases where all these adverse conditions (i.e., tunnels, heavy traffic, and electric traction) are met, particularly if on curves, it is becoming quite common to use a manganese steel rail, an average composition of which may be taken as follows:—Carbon, 1.0 per cent.; phosphorous, not over .1 per cent.; and manganese, 10 to 15 per cent. Rails of this nature are tested very carefully for soundness and for ductility, as opposed to brittleness. A steel of this nature is so hard that it is impossible to drill it in the field, and all holes have to be punched before the rail is placed in the track.

A very important point in connection with rail manufacture—or, more correctly, rail purchasing—is the thorough testing of the rail and steel. In this connection it is usual to make a chemical analysis of the steel, obtaining the proportions of the elements—carbon, manganese, phosphorus, silicon, and sulphur—for each heat, and in addition physical tests are made to determine the ductility and soundness of the rails. These tests are made by taking a length of rail about 4 feet long, supported at each end, and subjected to a number of blows from a "tup" usually weighing about one ton. In addition to this form of testing, if the elongation is satisfactory, a "nick and break" test is applied to determine the soundness of the metal in the centre of the rail. These test pieces are usually taken from at least three ingots of each heat.

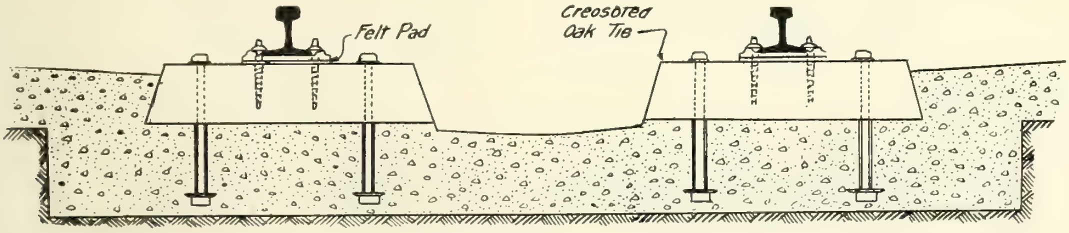


Fig. 5.—A form of track construction commonly used in large U. S. terminals.

Switches and Crossings

One of the most notable changes in connection with switchwork that has taken place in recent years is the use of a very much flatter frog. Until a few years ago it was quite unusual to find a switch with a frog flatter than the No. 10 or 12, whereas to-day a No. 20 frog is used as a standard for main line work on a large number of American roads, and a No. 24 even is used occasionally. A No. 20 switch has a lead of about 370 feet, but a curvature of only 1 deg. 45 min., whereas a No. 12 frog requires a curvature of 5 deg. The advantage of this is readily seen, particularly on a four-track road where crossovers from the main to the local tracks are more or less frequent. A train can pass from one track to another over a No. 20 crossover practically without slowing up, whereas a No. 12 crossover usually carries a speed restriction of 20 miles an hour. Another feature which has been introduced in order to enable trains to pass through a turnout at comparatively high speed is the shaping of the switch points into the form of a spiral, eliminating the sudden change from tangent to curve. The use of very long switch points, i.e., 30 or 33 feet long, also facilitates high speed operation, as the angle of a 33-ft. point with the stock rail is only 50 minutes, whereas the old 16 ft. 6 ins. point makes an angle of 1 deg. 40 min.

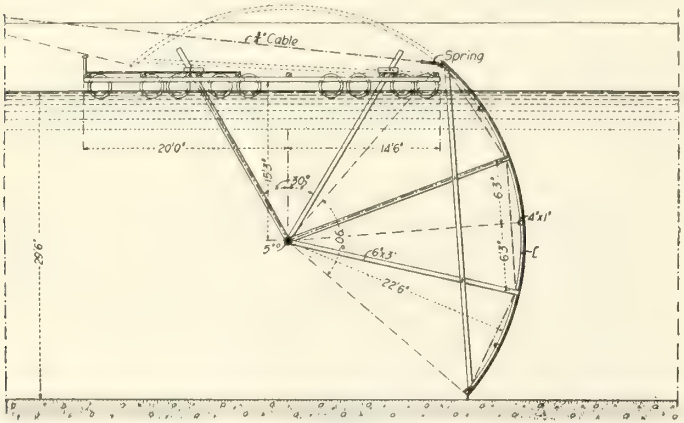
The extensive use of slip switch crossings has enabled track layouts at yards and terminals to be designed in such a way as to permit the maximum of movement of trains in and out of a terminal. A typical instance of the use of these crossings is illustrated in Fig. 3, where double ladders are used on each side of the main tracks, enabling incoming and outgoing trains to reach or leave their platform tracks with the minimum of interference. Switches and crossings used in terminal yards naturally have to withstand very rough usage, and it is essential that their life should be as long as possible on account of the difficulty of renewing them with traffic continually passing. To this end manganese steel is generally used at those parts of the switches or crossings where the maximum of wear is obtained. When manganese steel was first used for this purpose the switch points were made entirely of this steel, but it is now more common to use a switch point with a length of 30 inches at the point made of manganese steel. This is riveted to reinforcing straps on each side of the web, holding it securely in place. Crossing frogs are made with a cast manganese insert at the centre, but there are a number of variations of this practice, such as a frog built up entirely of manganese steel rails, or made in a single casting of manganese steel. The manganese insert is, however, most commonly used, and as the life of the other part of the frog is usually greater than that of the centre, the centre casting is renewed frequently. A slip switch heavily strengthened with manganese steel is illustrated in Fig. 4.

Concrete Track Construction

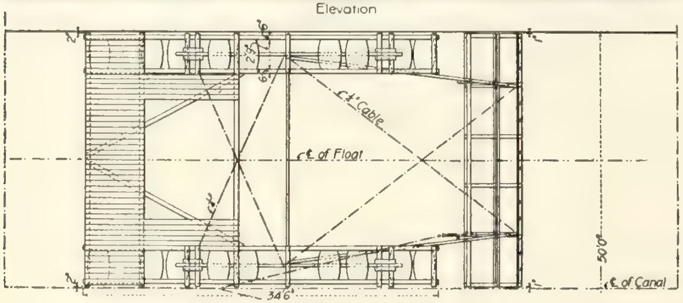
A form of track construction that is being commonly used in large terminals in the States is illustrated in Fig. 5. It differs radically from the standard ballasted track in that a solid bed of concrete is used in place of ballast. The rails are supported on short ties, 2 ft. 6 ins. long, embedded in the concrete and fastened in place by means of bolts. It is usual to place a hair felt pad between the tieplates and the tie in order to provide the resilience that is ordinarily obtained in ballast. This type of construction is now being frequently used for tracks adjacent to the passenger platforms in large terminals, partly on account of its extremely neat and clean appearance, and partly on account of the small amount of work necessary to maintain it in good shape, the only maintenance work being that of removing refuse. It is also being used, with variations, in tunnels. The disadvantages of the regular form of construction with ballast in tunnels are that considerable maintenance work is necessary, usually under adverse conditions, and that tie renewals are difficult because they cannot be taken out endways, as is usual in the open, but the whole rail must be removed and the tie lifted out vertically. This, of course, is a slow and tedious operation, and blocks the line for a considerable period. With concrete track construction these difficulties are eliminated, as maintenance is reduced to a minimum, and the renewals, which will only take place normally about every twenty or thirty years, can be made without disturbing the rail.

Measurement of Flow in Open Channels

MEASURING the flow of water in open channels is generally done by current meters or Pitot tubes. Both of these methods, however, require long periods of time, and other devices have been developed, says the Engineering Record. One of these methods that has been developed in Europe is the screen method, which in addition to being quicker than the other also is considered more accurate. Its inventor is Prof. Eric Andersson, of the University of Stockholm, Sweden. The method as first developed required a carefully aligned track on which a three-wheeled carriage ran. From this carriage the screen was suspended and hinged so that it could be dropped into position quickly. Several apparatuses of this kind have been installed, the most notable being at the testing flume of J. M. Voith, turbine builders at Heidenheim, Germany. At Notodden, Norway, there is another installation of the same type.



Elevation



Half Plan

Details of float and curved screen for measuring flow.

This type of screen is at this time considered antiquated, and is almost entirely brought out of date by the improvements which Professor Andersson has made on his method. The drawbacks of the method as originally devised were that a carefully aligned track was necessary, that the screen was vertical and thus when dropped had an angular movement, that the aluminum wheels and ball bearings of the carriage needed constant attention so as to ensure against excessive friction losses, and that wind pressure on the wheels increased the rolling friction.

In 1910, when the large turbines at Trollhattan in Sweden were to be tested, Professor Andersson revised the design of his apparatus and eliminated many of the above-mentioned drawbacks. The screen was curved and pivoted below the water surface, and the carriage replaced by a float. The apparatus is shown in the accompanying drawings. The float is supported on empty barrels, and is made of 6 x 6-in. lumber. The screen is made of light channels, metric system, about 2½ ins. high and 1.6 ins. wide, and weighing 4¾ lbs. a lineal foot, curved at a radius of 22 ft. 6 ins. On both sides of these channels, at frequent intervals, are 4 x 1-in. boards spaced in pairs and separated by small wooden blocks. Lateral stiffness was obtained by stretching ¼-in. cables diagonally in the panels. On this frame was fastened a cover of tarpaulin so as to obtain water-tightness. Four radial 6 x 3-in. timbers, two on each side, served to connect this screen with the submerged pivots on the float. Between the lower pair of these timbers a cross bracing of ¼-in. cable was made so as to prevent deformation. The whole apparatus was built in a way similar to that of a Tainter gate. At the bottom of the screen there was a loose, hinged part to provide a water seal against the bottom of the canal. The design of the float is apparent in the accompanying drawing.

As the canal was 50 ft. wide and 29 ft. 6 ins. deep, it was deemed wise to build the float and its screen in two parts, each 25 ft. wide, and connect them side by side when in use. This arrangement facilitated the construction and the handling of the device when not used for measurements.

The rectangular portion of the concrete canal is about 115 ft., and at its upstream end it is crossed by a highway bridge. On this bridge the recording apparatus was placed and connected with the screen by a ¾-in. wire rope, which was branched and thus connected with both halves of the float. The recording drum was driven by the pull on this cable at a speed one-twentieth the speed of the screen, while a pencil actuated by clock work marked every 0.01 min. The speed was also measured on a scale 65 ft. long laid out on the concrete work of the canal bank. Two men, each provided with a chronograph, recorded the time required by the screen to move a certain distance. In comparing the results of the two methods it was found that the chronographic method was less accurate than the diagram apparatus, and therefore its records were not used. As the discharge in the canal was used to feed the turbine under test, only the measured velocities were low, varying from 0.3241 to 0.8807 ft. a second, and the corresponding discharges from 508.9036 to 1375.5528 sec.-ft. Afterward the leakage through the gates on the spillway in the forebay and through the closed headgates was measured and found to be 1.7658 sec.-ft.

These tests were made June 24 to 26, 1910, under the supervision of Professor Andersson and E. Andren, at which time four main turbines had been installed. During May 10 to 13, 1913, when two more units had been installed, the screen was again used with very much the same results as described above. It was found, however, that the leakage had increased by 60 per cent., while the area of the headgates had been increased by less than 50 per cent. These latter tests were made under the supervision of A. H. Lindfors, Arvid Lindstrom, and Anders Rosborg.

What Constitutes a Completed Job of Road Work

By A. McGillivray, Highway Commissioner for Manitoba

IT would be a source of profoundest gratification indeed to road builders, municipal men and ratepayers alike, if at some time in the history of a road it would be possible to say that it was completed and that no more attention need be given it. This is an ideal condition in the life of a road that cannot be hoped to be attained. However, there are certain factors that enter into the building of a road that can be settled definitely and remain permanent fixtures therein.

The first point that should be settled before actual construction begins, is the location of the road. This is determined by its relative position in the district to be served, the comparative cost of construction with other locations and its general suitability to the purpose intended. The allowances set apart for road purposes in the Prairie Provinces of Canada are defined in the original survey of the country into its legal subdivisions, and follow the boundary lines of the sections. This in itself, while providing a right-of-way for road purposes at regular intervals throughout the country, often proves a source of extra engineering difficulties and expense when they are being transformed into travelled ways. The lines of demarkation of the townships and sections are run in set directions—north and south, and east and west—regardless of the topography or physical feature of the country. The efforts of the highway engineer, in so far as selecting the most suitable location for a road are, therefore, very much circumscribed and limited by having to accept the allowance thus provided for that purpose.

The alignment of the road should receive careful attention when construction work is being undertaken and improvements are being performed.

Whether the right-of-way selected be a Government road allowance or a diversion therefrom, which latter course in some instances is absolutely necessary in order to avoid large bodies of water or hills which could only be crossed by following a straight course at prohibitive gradients or unwarranted costs, the centre line of the roadway should be fixed and the proposed improvement made about it so that where subsequent improvements or alterations in standard of road are found desirable, they may be made without disturbing work previously done.

It is customary, when laying out road work in this province, for the engineer to make the centre line of the roadway coincide with the centre line of the road allowance, and unless there be good and sufficient reasons present in a given case for deviating from this by placing the travelled road in some other relative position on the allowance, this rule should be strictly adhered to. The point to be emphasized in this connection is, that the finished roadway, the necessary drains, culverts, and bridges should conform to such well defined lines and courses that their positions on the road allowance may become, practically, permanent fixtures. It might be here stated that the width of roadway on rural main roads should be 18 feet. This width should be increased at the approach of towns and cities to 20 and 24 feet, depending altogether on the amount of traffic to be accommodated. The inside lines of the ditches should be parallel with the centre line of the roadway, and not closer than 14 feet thereto. This arrangement will give a stretch of ground twenty-eight feet in width upon which to construct the roadway. The slopes of embankments and cutting, except in rock, should have, at the least, a slope of one foot and one-half horizontal measurement to one foot vertical.

Another important feature in connection with the building of a road is the determining of the profile which the surface of the finished roadway should assume. This is accomplished by a study of the profile of the natural surface of the ground to be traversed, and by so altering the same by means of embankments over stretches of comparatively level country, or by cutting down hills and elevating the intervening depressions where the surface of the country is rolling or broken, until a finished profile suitable to the nature and conditions of the soil met with is obtained. It is largely a matter of judgment based on knowledge gained from experience that enables an engineer to determine the proper height of fill which should be constructed across a certain stretch of country or the depth of cutting that should be made through a ridge. No said standard can be fixed to meet the varying conditions met with. If the land is low and flat, and is liable to be affected by the accumulation of water in times of freshets, the embankments will necessarily have to be higher than over land where drainage is more easily effected. Where the country is rolling and the profile a series of ridges and depressions, an excellent road can be made by cutting the ridges and filling in the depressions and a grade line so established that the amount of excavated material from the ridges and the amount of the material in the embankment would balance. Again there may be met with tracts of country where the soil is light, and natural drainage good, where the surface of the ground may be but little disturbed to provide a splendid roadway.

It is when building a road over a steep hill or across deep ravines, or across the valleys of some of the larger rivers in this country, where the determining of a proper profile for a road requires consideration and thought. The maximum gradient which might be permitted on a main highway is six per cent., or a rise of six feet in every one hundred feet horizontal measurement. A much less gradient should be first sought and the maximum aforementioned only adopted when the engineers' difficulties encountered are of such a character that the cost of securing any substantial reduction might be considered prohibitive or unjustifiable.

The gradient of a hill may be reduced by increasing the depth of the summit cutting or by increasing the length of the road. The latter method is preferable. Deep cuttings are objectionable, especially as in the winter seasons, unless protected by snow fences, they are liable to drift full of snow and cause blockades on the road. While it is almost impossible to entirely avoid them in rough mountainous regions, still, in endeavoring to reduce the gradient, distance should be increased by following the most practical course open along the slope of the hill until the bottom is reached, where the direction may be corrected on the flats below.

The bad effects of the steepness of hills are especially felt in the winter, when the ice covers the road, because the slippery surface causes danger in descending, as well as increased labor in ascending. If a hill has to be ascended, the road up it should nowhere have the smallest descent, for that would make two hills instead of one. It should be so located, and have such cuttings and fillings, as will secure a gradual and uninterrupted ascent the whole way. In this respect engineering skill can make wonderful improvements and will assist wonderfully in selecting the best possible location for the road.

No job of road construction can be considered completed that does not provide adequate drainage facilities. By this is meant the construction of the necessary surface drains, or underground system of tile drains, and the placing of all culverts required in connection therewith, so as to permit the escape of all water which may accumulate along the road.

The cross section of the road should be so shaped that water will not lie upon its surface, but will have free and uninterrupted access to the gutters or side drains. This is a very essential factor in the life of a road. The construction and preservation of a properly shaped cross section adds to the comforts and conveniences of travel upon it, and lengthens the life and usefulness of the road to an inestimable extent.

The cross section of an earth road will require a greater rise at the centre than a hard surface road, but care should be taken not to make this excessive, because it will have the effect of concentrating the traffic at the centre—that being the only part of the road where a vehicle can retain an upright position and thereby cause ruts to be formed which will prevent the rain water falling on the surface to escape to the side gutters; very much to the injury of the road. The rise given to the crown of a road should bear a certain proportion to the width of the roadway. For earth and gravel roads, this rise should be about one twenty-fourth of the width of the road surface. Macadam roads do not require this amount, and possibly about one-fortieth of the width would be sufficient. On asphalt, brick, creosoted wood block, or other surface, the rise may be reduced still more.

Upon the foundation depends the permanency and stability of any road whether it be the common earth road or the highest class of pavement. If the foundation is weak and faulty, the surface will soon become broken and impassable. The character of the natural soil over which the roadway is to pass has an important bearing on the forming and kind of foundation. But whatever be the character of the soil, it must be kept dry. Sands and gravel which do not hold water present no great difficulties in securing a solid foundation. It is with clays and soils of retentive nature where the greatest difficulties are encountered.

The essentials necessary to forming a good foundation are:

(1) The entire removal of all perishable or yielding material.

(2) The drainage of the sub-soil wherever necessary.

(3) The compaction of the natural soil by a roller of proper weight and shape.

Where the traffic demands a more substantial and unyielding foundation than the natural soil will afford, a fourth essential may become necessary, as the placing upon the natural soil compacted as aforementioned a sufficient thickness of hard durable material such as rock or concrete.

It is the foundation of a road alone, where even relative permanency is possible to be secured, and this can only be accomplished by exercising the greatest care in forming it and afterwards protecting it from the destroying actions of traffic and the elements by a suitable wearing surface.

This wearing surface may consist of a coating of gravel, macadam, asphalt, brick, or other pavement that will act as a protection to the foundation. Upon it comes the inevitable wear and tear of traffic and in a well designed and constructed road this should be the only portion requiring repairs or replacement so long as the original design of the road remains suitable for the traffic upon it or capable of withstanding any extra traffic that it may through time be exposed to.

A completed job of road work should include permanence of location, adequate drainage facilities, foundations and surface covering compatible with the demands of traffic upon it so that transportation and intercommunication can be carried on with safety to the public with the least possible inconvenience and the lowest possible cost.

Specifications for Concrete Pavements

SOME interesting points in the specifications for concrete pavements, written by M. M. O'Shaughnessy, City Engineer of San Francisco, and recently adopted by the Board of Supervisors, follow: The concrete is of 1:2:3½ mixture. After mixing, the concrete is deposited rapidly in successive batches; the concrete is deposited to the required depth and for the entire width of the pavement in a continuous operation between transverse and longitudinal joints without the use of intermediate forms or bulkheads. In case of a breakdown, concrete must be mixed by hand to complete the section or to an intermediate transverse joint placed at the point of stopping work. Any concrete in excess of that needed to complete a section at the stopping of work is not to be used in the work. Longitudinal joints filled with ⅛ in. of prepared felt are constructed between the curb and the pavement on each side of the roadway, and along the centre line where the roadway exceeds 25 ft. in width. Transverse expansion joints are constructed in straight lines at right angles to the centre line of the roadway for the full width of the pavement and at intervals not exceeding 25 ft. The surface of the pavement is sprayed with water as soon as the concrete is sufficiently hardened to prevent pitting and is kept wet until a sand covering is placed. As soon as this can be done without damaging the concrete, the surface of the pavement is covered with a layer of sand at least 1-in. thick, and covering kept moist for at least 10 days. The pavement is not to be opened for traffic for a period of at least 20 days after being laid. The contractor is required to maintain the sand covering for a period of at least 10 days and must erect and maintain barriers to protect the concrete from traffic, and any part of the pavement damaged by traffic or other causes prior to its official acceptance must be repaired or replaced by the contractor at his own expense in a manner satisfactory to the engineer.

Concrete as a Paving Material

By J. F. Rhodes[1]

DURING the last few years the use of concrete as a paving material has had a very rapid growth both in Canada and the United States. Up to the end of the year 1907 records show that only twenty-seven municipalities in the United States and four in Canada had used concrete.

The most noteworthy of the early pavements in the United States is that at Bellefontaine, Ohio, which was constructed in 1893. This pavement was laid on the market square which naturally was subjected to heavy traffic. After standing traffic twenty-two years, it is still in use and in good condition. Other early users in the United States were Richmond, Ind., and Chicago, Ill. The latter city laid 80,000 square yards previous to 1908.

The early users in Canada were Toronto, Woodstock, and Windsor, Ont. The two former places used it only in lanes, Toronto first laying concrete in 1898, and Woodstock in 1905. Toronto continued its use in lanes to a very limited extent until 1913. During the years 1913 and 1914 the city laid approximately six miles. Windsor first used concrete for street paving in 1907, when they constructed six streets, totalling 35,000 square yards, at a cost of approximately $1.00 per square yard. Windsor at present has approximately twenty-five miles of concrete in residential streets and it is practically their standard type of construction.

During the last few years the increased yardage of concrete has been very marked. Below are tables showing the approximate yardage laid in Canada and the United States to date. In Canada a large percentage of the concrete has been laid as pavements in municipalities. The largest system of concrete pavements is in Windsor, mentioned previously, and the longest rural highway is that in Laval County, Que., on Isle Jesus, from Pont Viau to the Ste. Rose Parish, a distance of 6½ miles. The following table gives data on Canadian concrete pavements:

Year	Number of Places	Yardage	Total Yardage
Up to 1908	3	42,189	42,189
1908	3	30,617	72,806
1909	4	24,983	97,789
1910	8	158,790	256,579
1911	9	86,605	343,184
1912	18	237,622	580,806
1913	38	468,799	1,049,605
1914	41	550,305	1,599,910

In the table showing concrete pavements in the United States, the yardage includes both city streets and rural highways. Data is not at hand which shows what proportion is city street paving. However, statistics indicate that 286 cities in the United States built concrete in 1914 totalling 4,787,003.56 square yards. Previous to 1914, 448 municipalities had used concrete for street paving.

Concrete Pavements in the United States

Year	Amount	Total Amount
Up to 1909	1,141,500	1,141,500
1909	274,000	1,415,500
1910	1,026,600	2,442,100
1911	1,861,100	4,303,200
1912	5,556,656	9,579,856
1913	8,576,160	18,436,016
1914	Not complete	....

In the development of concrete pavements many changes have been made in their design and construction. In the early work they were built on the same principle as sidewalks, having a bottom course of concrete with a cement and sand top, and finished in the same manner as sidewalks. It is now more general to build the pavements of one-course concrete throughout, using a rich mixture of concrete, the standard specifications being in proportions of 1 part of cement to 2 parts of sand and 3 parts of crushed stone or coarse gravel. It is also the custom to make joints in the pavements at intervals of not less than 25 feet, in place of making them in small slabs as in the earlier ones. When using concrete for the paving of city streets and in all roadways which are 20 feet or more in width, it is becoming the practice to reinforce them by the use of a woven steel fabric placed not less than 2 inches or more than 3 inches from the top surface of the pavement. This reinforcing is intended to overcome the chances of cracking of the concrete from the shrinkage stresses and the stresses induced by the moisture contained in the concrete. Where reinforcing is used for bad conditions in the foundation this has to be designed according to special conditions.

There has also been a great advance in the manner in which concrete for street purposes is constructed. The work is now done much more rapidly owing to the use of better machinery, and greater care is taken with the mixing of the concrete. The latest specifications require that all the concrete should be mixed at least three-quarters of a minute in the batch mixers. This is done in order to obtain a concrete which will be absolutely uniform and thereby wear at the same rate in all places, and be of uniform strength throughout.

From results already obtained in concrete street paving many engineers are of opinion that concrete, when properly built, gives one of the most durable pavements for the money expended.

Sixty-three municipalities in Canada have constructed concrete pavements, and nearly all of these have added to the streets first built. This indicates that concrete pavements are meeting the needs of many municipalities and are proving satisfactory to those who use them.

* * *

Production of potash from feldspar by a new process is described by E. W. Coggeshall in a paper before the National Lime Manufacturers' Association. Powdered feldspar is mixed with one-fifth its weight of powdered quicklime and sprinkled with a solution of calcium chloride. The calcium chloride binds the powder into lumps. These lumps are fed to a rotary kiln similar to a cement kiln, and under the influence of the high heat the potash in the feldspar is released from its union with the silica and unites with the chlorine to form muriate of potash, which is readily soluble in water. By leaching the lumps discharged from the kiln, a solution of about 10 per cent. of muriate of potash is obtained. The water in the solution is evaporated by the waste from the kiln gases. It is stated that the potash salts obtainable in this way can be produced commercially for a lower figure than those imported from Germany under normal conditions. The total importations of potash salts from Germany during 1914, notwithstanding the interruption to the business during the last four months of the year, amounted to nearly 486,000,000 pounds, valued at $8,750,000.

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[1] Of the Canada Cement Company.

The Economics of Pavement Repairing

Providing a Roadway for an Indefinite Continuous Period at Minimum Expense—Method of Determining Limit beyond which Cost of Maintenance by Repair Exceeds that of Renewal

HOWEVER well a roadway may be constructed, there must be repairs, and such will increase in extent and expense until a limit is reacher where renewals are dictated by considerations of economy, says George H. Norton in an article in The Cornell Civil Engineer. While there may be an interesteg possibility of maintaining a roadway in satisfactory service by continued repairs for an indefinite time, such to-day appears a remote contingency. The requirement to be met is that of minimum expense for providing a roadway for an indefinite continuous period of time, or determination of the limit where maintenance by repair exceeds in cost maintenance by renewal. To determine this limitation we must know the cost of repairs year by year and the cost of renewal, which theoretically may be the same as the cost of original construction.

Some hold that sinking fund provisions, etc., should enter into this determination, but a full consideration of the various methods by which funds are provided and the varying values of moneys to the diverse contributors to the expense seem to make this an unnecessary refinement, at least until a general theory is better founded and accepted.

For this discussion we accept the fact that pavement repairs increase with the age of the pavement, and will further assume that the cost of renewal of wearing surface is equal to the original cost of providing such surface.

Where repairs increase directly as the first power of the age, then the economical limit of life is reached when the total cost of repairs equals the cost of the article. When these repairs increase with the square of the age, then the limit is reached when repair cost equals one-half that of the article. If the repair rate increases by any uniform rate, then a mathematical solution can be reached for minimum cost of providing a continuous surface by repairs or renewal.

Unfortunately, the variations in soil, climate, traffic, and materials, plus the ever-present limitations of human judgment, make most unlikely any regular curve of increase in repair cost of a single road or pavement. No average result of a number of examples can be truthfully used as a criterion for a single case. The determination must, therefore, be made from the record of the individual pavement, although such determination may well be made in the light of a knowledge of general behavior and limitations of other similar construction. The method here proposed is simple in its application, readily understood by the layman, and is apparently as accurate as this problem at its best will warrant.

To determine the economical limit of repairs two variables must be considered, and the limit will occur at the minimum of their sum. If a pavement surface is used for twenty years, one-twentieth of its cost may be taken as its annual depreciation; but if in use but ten years, then one-tenth the cost is the annual depreciation. For any particular class of pavements there may be prepared a table of depreciation by dividing the cost of renewable surface by numbers representing the age of the pavement. For the cost of repairs, if at the end of ten years 10 cents per yard has been expended for repairs, the average rate has been one cent per year. If at the end of twenty years 60 cents per yard has been expended, then the average repair rate has been three cents per yard per year.

For an application of this method the following tabulation is made:—

Age	Annual cost of repairs		Average annual cost of of repairs	Annual allowance for renewal	Annual cost of pavement
1 to 7	....	3.0	....	....	....
8	2.7	5.7	0.7	18.8	19.5
9	0.8	6.5	0.7	16.7	17.4
10	12.9	19.4	1.9	15.0	16.9
11	4.9	24.3	2.2	13.6	15.8
12	0.6	24.9	2.1	12.5	14.6
13	2.1	27.0	2.1	11.5	13.6
14	2.2	29.2	2.1	10.7	12.8
15	1.4	30.6	2.0	10.0	12.0
16	0.9	31.5	2.0	9.4	11.4
17	2.9	34.4	2.0	8.8	10.8
18	3.0	37.4	2.1	8.3	10.4
19	0.3	37.7	2.0	7.9	9.9
20	3.1	40.8	2.0	7.5	9.5
21	5.8	46.6	2.2	7.1	9.3
22	3.5	50.1	2.3	6.8	9.1
23	9.6	59.7	2.6	6.5	9.1
24	5.9	65.6	2.7	6.3	9.0
25	4.2	69.8	2.8	6.0	8.8
26	....	69.8	2.7	5.8	8.5
27	8.3	78.1	2.9	5.6	8.5
28	12.5	90.6	3.2	5.4	8.6
29	6.9	97.5	3.4	5.2	8.6
30	5.0	102.5	3.4	5.0	8.4
31	5.2	107.7	3.5	4.8	8.3

In the above tabulation the cost of renewable surface is assumed at $1.50 a square yard. This amount is divided by the consecutive numbers representing age of pavement (column 1), and gives the annual allowance for depreciation as shown in column 5. The actual expenditures made annually for repairs per square yard are given in column 2. In column 3 are shown the totals of such repair cost to the given year, and in column 4 the average cost of repairs per year to that date (column 3 divided by column 1). Column 6 (the sums of columns 4 and 5) shows the cost of depreciation plus cost of repairs, and in this is to be found the minimum or limit of repairs. This example shows that the cost of providing the pavement over a term of years, depreciation plus repairs, had been a decreasing one except in the 28th year, where a large repair expenditure had raised the annual cost, but that a lower cost was reached thereafter.

An immediate use of such a tabulation is found in determination of the allowable repairs for any year. An inspection at once shows, with an annual cost of 9.5 cents per yard per year at the 20th year, that if 9.5 cents be expended in the 21st year the annual cost rate will remain the same. As the repairs in the 21st year were less than 9.5 cents (5.8 cents) the average annual cost was reduced to 9.3 cents. Had it exceeded 9.5 cents the average annual cost would have been increased. From the above considerations the following rule is formulated:

The allowable repairs for a succeeding year should not exceed the sum of the total cost of repairs to date, plus the cost of the wearing surface, divided by the age of pavement, and when the necessary repairs would exceed such amount the street should be resurfaced. This rule, like the celebrated artist's paints, should be applied with brains. It is believed to be sound, simple, easy of application, and a valuable aid to an engineer's broad judgment.

To fairly discuss the rule some applications are given. These are from maintenance records of sheet asphalt pavements in Buffalo, N.Y., where detailed records of yearly costs are available for nearly 700 contracts. In figure 1 are shown annual cost (repairs plus depreciation) for six streets with fairly uniform repairs. There is also plotted for reference the curve of depreciation (cost—150 cents—divided by age), all figures in cents per square yard. Fig. 2 shows the same record for three streets in which the rule of minimum cost has been violated and repairs continued.

These streets may be described briefly as follows:

(1) 17,235 square yards, heavy traffic, about 5,000 tons per day, now in good condition except somewhat uneven.

(2) 5,800 square yards, heavy traffic street. Condemned in 24th year.

(3) 19,100 square yards, medium traffic street. General conditions warrant an early condemnation.

(4) 22,500 square yards, medium traffic. Condemned in 31st year and repaved in 32nd year. This street is used for further study in figure 3.

(5) 8,900 square yards, residence street. Laid on a bituminous base. Surface worn very thin, but bituminous base prevents deep holes.

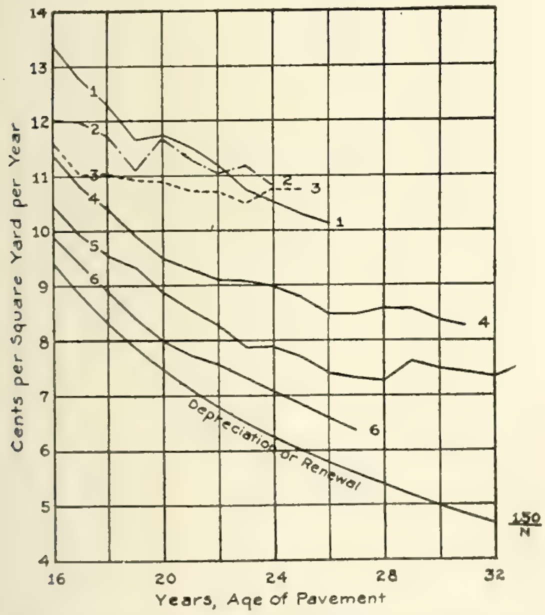

FIG. 1. ANNUAL COST OF CERTAIN PAVEMENTS AT VARIOUS AGES.

Cost of surface plus cost of repairs divided by age of pavement, with depreciation or renewal curve for determination of minimum cost.

(6) 5,800 square yards, short residence street of exceptionally low repair costs, 0.8 cent per yard per year for 27 years; apparently destined for long life.

(7) 7,000 square yards, residence street in fairly serviceable condition. In its 22nd and 23rd years 27.6 cents per yard was expended for repairs.

(8) 13,400 square yards, medium traffic street. One of several streets laid same year on which guarantee was voluntarily extended 3 years. In its 24th and 25th years 48.6 cents per square yard was expended for repairs. Now in fair condition.

(9) 18,200 square yards, medium traffic residence street, now in fair condition. In 22nd and 23rd years 20.9 cents per square yard was expended for repairs.

Some irregularities in these lines are due to known insufficiency of repairs or entire omission for one year.

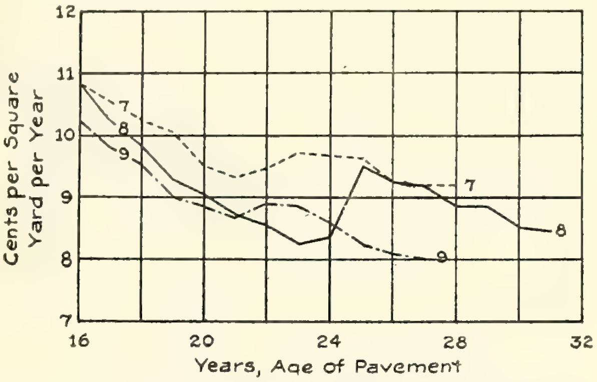

FIG. 2. ANNUAL COST OF CERTAIN PAVEMENTS AT VARIOUS AGES.

Cost of surface plus cost of repairs, divided by age of pavement, where minimum cost rule has been violated.

In applying this rule several points should be borne in mind:

(a) Repairs due to settlements or other local causes may warrant a high rate when such repairs may place the whole surface in a satisfactory condition.

(b) Known deficiencies of repairs for a period followed by such as replace deficiency must be given due consideration.

(c) Due regard for general condition of whole surface. Occasionally pavements exhibit some traits of the celebrated "one horse shay."

(d) If a pavement is plainly of quality below the average of its kind, its annual costs, while decreasing, may be so much above the reasonable expectations for its successor that the rule should be drawn tightly or perhaps forced; while with the reverse condition some leniency may be felt for one which is giving better than average service. This is illustrated by No. 5 above.

The impossibility of making such uniform repairs as to create a smooth curve of annual cost demands a careful study of the line, and a smoothed or average curve of cost may well be sketched and studied in making final decision.

This rule has been applied in Buffalo for about three years, at first as a check upon the opinions of those long in charge of such work, and later as a guide in the formation of such opinions, and it has been found to be most sound and to conform to judgment based on extended experience.

The argument for the use of a sinking fund curve instead of a straight depreciation, while theoretically warranted, has little practical merit.

In Fig. 3 is shown line A_1, straight depreciation or cost divided by age; line B_1 is the sinking fund curve at 4 per cent. compound interest to produce $1.50 at the given age. They depart from the parallel by only about 0.1 cent between 20 and 30 year ages—an immaterial amount. Above these lines have been plotted, as lines A and B, the record of street No. 4 of

Fig. 1, based respectively on straight and sinking fund depreciation; they show no appreciable difference in character to warrant use of the more complicated sinking fund provision.

Another element may well enter into this problem. In the above discussion no allowance has been made for deteriorated condition of a roadway during its determined life. Generally an old surface will be uneven and less desirable even if intact and serviceable, and at times some weight should be given to such condition. It is possible in the rule herein suggested to make allowance for a deteriorated useful value of a wearing surface and also give weight to losses occasioned through interruption of traffic in resurfacing by decreasing or increasing the assumed value of the wearing surface.

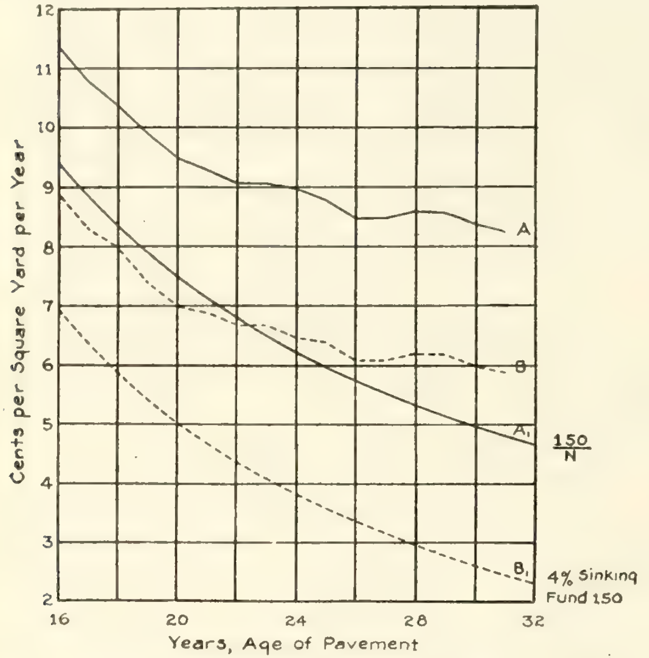

Fig. 3. Flat depreciation or renewal compared with sinking fund provision to show parallelism at critical ages. Repair costs of street No. 4, Fig. 1, added to show similarity of lines of cost.

No attempt has been made to discuss the various theories which have been advanced for this purpose, as such would of necessity be somewhat controversial. The pure theory of limitations of repairs may well have more extended and public discussion than is generally accorded to it. It is of the essence of sound engineering and of vast financial import.

Work on the Second Simplon Tunnel continues in spite of the entrance of Italy into the war. The south end of the tunnel is on Italian territory, the north on Swiss territory; but at present work on the north end is discontinued, while progress at the south end was not interrupted when Italy declared war, except that the number of workmen was reduced by the call to colours, which required the recruiting of a new force. The May advance of each of the various elements of the work (crown heading, full section excavation, sidewall construction, arch construction) in the south end was about 875 ft.; heading work was prosecuted from a number of upraises. The total length of completed tunnel at the end of May was 15,232 ft. in the south end, and 15,987 ft. in the north end, or a total of 31,219 ft., representing 48 per cent. of the final length of the second Simplon Tunnel (65,026 ft.).

The Design of Reinforced Concrete Reservoirs*

SOME of the advantages of reinforced concrete as the material of construction for water-works reservoirs are: there is a saving in first cost; a reservoir built of this material occupies less space than one constructed in masonry or brickwork, or a combination of both; it can more easily be made watertight; it increases in strength with age; there is less likely to be vegetation upon the face of the walls; practically no cost in maintenance.

Circular vs. Rectangular Reservoirs.—In the United States most of the modern reservoirs are circular in plan. Reservoirs of this shape are seldom constructed in England, British engineers preferring a rectangular structure. I recommend the circular shape, the chief advantage being that when of this shape no angles occur, so that the reservoir wall can be built without a joint. This is a great advantage, for one often finds that when leakage occurs in a reservoir it can be traced to the point where the walls join. Circular reservoirs, because of their circular form, are also better adapted to withstand external earth pressure; they are cheaper than rectangular ones.

The Twin Peaks reservoir at San Francisco is a good illustration of the curvilinear type of reservoir. This may be briefly described as follows:

The reservoir was completed about two years ago, and is a good example of what may be done in reinforced concrete. It is oval in plan, and divided into two parts by a reinforced-concrete dam. The reservoir is situated 750 ft. above the business section of the city, and is part of the high-pressure system for fire-extinguishing purposes established in consequence of the great fire of 1906. The depth of water allowed for is 27 ft., and the capacity is 11,000,000 gals. The buttresses of the dam are spaced at 9-ft. centres on both sides of the wall. They are 1 ft. in thickness, and 13 ft. wide at the base.

Watertight Reservoirs.—Referring to the leakage of reservoirs, we would say that this is a problem which has engaged the serious attention of engineers for many years past. Reservoirs have been constructed in what appeared to be a substantial manner, on a good foundation, and at a cost of many thousands of dollars, but they have never ceased to leak, and while many attempts at remedying the leakage have been made, these constructions are looked upon, from an engineering point of view, as a failure.

I know of no type of reservoir, however, which is more likely to be watertight than that constructed of reinforced concrete, provided the reservoir is properly constructed and expansion joints are inserted in suitable positions both in the walls and floor of the reservoir, and if suitable material is used for the concrete, and the walls are not less than a minimum thickness of 5 inches and are well reinforced, and that the depth of water in the reservoir does not exceed, say, 30 feet.

The thickness of the floor will depend entirely upon the sub-foundation. This floor may be either of plain or reinforced concrete; if the latter and the sub-foundation is good, the thickness of floor should not be less than 6 ins. for a depth of water up to 15 ft., and 9 ins. for a depth ranging from 15 to 25 ft., and 12 ins. from 25 ft. to, say, 35 ft. In every case it is assumed that the floor is well reinforced. In order that the reservoir may be watertight, in addition to the before-named precautions, great care must be taken as to the properties used in the concrete. I would suggest that never should a weaker mixture be used than 1:2:4, and where the depth of water to be stored is not less than, say, 20 ft., I would recommend a mixture of 1:1½:3. The materials should be very carefully graded, as most of the trouble in reservoir work occurs where this has been imperfectly done.

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*From an address by Prof. E. R. Matthews, of the Department of Municipal Engineering of the University of London, given at University College, London, Eng.

I also recommend for reservoir work that a wet mixture shall always be used, and while a dry mixture may show a better result as regards its strength in compression, and a plastic mixture may also give better results in this way, still, a wet mixture more perfectly prevents leakage, and on that account should always be used.

Not only so, but with a wet mixture the reinforcement is better covered. I have seen reinforced-concrete work where a fairly dry mixture had been used, and where occasion had arisen for the breaking up of the concrete, where the reinforcement in places had not been covered in the least degree by the concrete. This had occurred, first, because the mixture was too dry, and, secondly, because the aggregate used was too large. In practice the concrete should be of such a consistency that every portion of the reinforcement will be well covered, and every crevice filled.

Not only is this obtained by using a wet mixture, but with such a mixture when the forms are removed there is a smooth face to the concrete, and on this account also it is wise that the mixture should be fairly wet. Care, however, must be taken to see that it is not too wet. It is possible for too large a quantity of water to be added so that the grout will run through the joints in the forms, and escape from the wall; on no account should this occur. If reservoir walls are constructed with a mixture of 1:2:4, the ultimate strength of this concrete, assuming well-graded stone and sharp sand is used as the aggregate, will be about 2,000 lbs. per square inch at the termination of one month, and 2,700 lbs. per square inch at the end of six months. The usual working stress for good concrete is taken at 600 lbs. per square inch. Under exceptional circumstances, however, this may be reduced to, say, 500 lbs., but I would recommend, generally speaking, for reservoir work, 600 lbs. per square inch.

Reservoir Piers.—These are sometimes built circular in plan, and there is a slight saving in the space occupied by so doing. It is, however, more costly to construct the forms in this shape, and the advantage of saving in space does not really compensate for the increased cost. The usual practice in this country is to build rectangular piers, and to chamfer the edges, say, with a 1½-in. chamfer to a 10-in. or 12-in. square pier. The square pier has the advantage also that it affords a better seat for the reinforced-concrete beams carrying the roof to rest upon.

Reservoir Roofs.—In reinforced-concrete reservoirs this usually consists of a reinforced-concrete slab 5 ins. or 6 ins. in thickness, carried by reinforced-concrete beams which rest on the piers just referred to. Some engineers prefer a lighter slab, and to ensure this they introduce a system of secondary beams. For my own part I do not care for the roof slab to be of greater thickness than 6 ins.; 5 ins. is preferable, and the beams can be designed accordingly. In calculating the weight of the roof it is necessary to include the weight of concrete and reinforcement forming the beams and slags, also to allow for any soil which may be spread on the roof. This is usually about 1 ft. or 18 ins. in thickness, also to assume a thickness of snow of, say, 2 ft. It is necessary to construct two or three openings in the roof for the purpose of getting to the inside of the reservoir, and iron ladders are usually built in at these points. The openings need not be larger than 6 ft. by 3 ft.

Cement Grouting.—It is always advisable after short sections of the work have been completed to wash the walls over with two coats of cement grout, 1 to 1 (sand and cement). This fills in any slight cracks which may have occurred on the surface of the concrete. A fortnight should elapse before the grout is applied. No further cracks on the surface of the concrete will be likely to occur.

Wetting Concrete.—If the reservoir is being built during the summer months, when the sun is likely to dry the surface of the concrete very rapidly, the latter should be frequently wetted so as to retard the driving action of the sun. It is also advisable to do this in high winds.

Size of Aggregate.—In reservoir work the aggregate used in the construction of the concrete walls, floor, piers and beams of the reservoir should be capable of passing through a ¾-in. ring; for the roof slabs it should be capable of passing through a ½-in. ring.

Where the thickness of the concrete floor exceeds 9 ins. the aggregate should be capable of passing through a 1-in. ring, the upper 4 ins. of the concrete in the floor should consist of concrete, the aggregate of which is capable of passing through a ¾-in. ring.

Reinforcement.—It is not my intention to advocate any particular system of reinforcement. There are many in the market, and most of them are good, and I say this after having used several different systems myself. It is quite possible, however, and I strongly advise you to adopt this course, for the municipal engineer to work out his own stresses and design his own system of reinforcement.

Thickness of Walls.—For heads up to 10 ft. a 5-in. wall will generally be found to be sufficient; a 4-in.

MY SON

I that had yearned for youth, my own, again,
And mourned the wasted hours of younger days,
I that had sighed for Spring, for Summer, when
The snows of Winter covered all my ways—
I that had prayer for years, for only one,
Have found that prayer answered in my son.

He is myself again, with hopes of old,
With old temptations and with old desires:
He is myself again—the clay to mold
Into the man, and all the man aspires.
Who says that youth returns to us no more?
He is as I was in the days of yore.

In my own days, in my own days of youth,
Ah, how I wished a comrade and a friend!—
To help me keep the quiet path of truth
And through temptation my own feet attend.
So shall I journey onward by his side,
His father—yes, his comrade and his guide.

I that have failed shall shape success in his,
I that have wandered point the proper path,
A signal when the signal lights are dim,
A roof to fend him from the storms of wrath—
So we shall journey upward, I and he,
And he shall be the man I meant to be.

—Douglass Malloch.

will answer, but I prefer a minimum thickness of wall of 5 ins. It has, however, been suggested that the walls should be increased in thickness for every additional 5 ft. increase in head pressure. I agree with this suggestion, but prefer that the top 6 ft. of the reservoir wall shall be 5 ins. in thickness, and that the wall shall be increased in thickness by 2 ins. for every additional 6 ft. of its height.

It is usually desirable to build counterforts or buttresses at the back of the wall.

There is a saving of from 20 to 25 per cent. by using reinforced concrete in the construction of reservoirs. Some engineers recommend that the water face or reservoir walls shall be plastered with 1 to 1 cement mortar to a thickness of ½ in. or ¾ in., but I do not favor this; I think it is unnecessary.

Stresses.—The elongation of steel being so much greater than that of concrete, it is advisable, in order to ensure of the reservoir being watertight, to limit the stress to 12,000 lbs. per square inch, and I think it is advisable in reservoir work to use bars which give a mechanical bond, such as the indented bar, twisted bar, lug bar, or one of the other various types of bars, rather than plain bars, but this only applies to reservoir work, as plain bars are admirable for all other reinforced concrete work.

It is necessary that an adequate percentage of steel be inserted in the concrete in both directions, even when the stresses due to water pressure occur in one direction only, or otherwise slight cracks may occur.

Backing of Reservoir Walls

Reservoirs may be: (a) Entirely sunk below ground; (b) partly sunk below ground; (c) out of ground.

(a) **Reservoirs Sunk Below Ground.**—On designing the first type we must remember that the reservoir may be full or empty. When empty the walls will be acting as retaining walls with all the pressure at the back; when the reservoir is full there is still the pressure of the soil at the back of the walls, but counteracting this is the water pressure from within. It is therefore desirable that walls of this class shall have reinforcement on both sides, and not in the centre of the wall, as had the reservoir which failed at Mittagong, N. S. W.

(b) **Reservoir Partly Out of Ground.**—These are known as the cantilever type. In determining the width of the heel we must remember that in an ordinary retaining wall the weight of the earth at the back of the wall would help to keep the wall from overturning, but with a reservoir the weight of water should be disregarded. The heel should therefore be made of sufficient width and thickness to be stable when the weight of water above it is neglected. One of the most important things to be careful with in designing a reinforced concrete reservoir is the arrangement of the bars at the joint between the vertical wall and the footing.

(c) **Reservoirs Out of Ground.**—These will be similar in design, but buttresses are usually added. The wall acts as a dam to withstand water pressure.

Reservoir Roof

The reservoir roof often acts as a tie, and holds the reservoir walls together; the reinforcement is therefore arranged accordingly. When the span is large, however, the elongation may be considerable, and it is then not advisable to tie the walls in this way, but to give the roof free sides for expansion.

An Interesting Experience with Cement Floors

FOR a long time the Chief Trade Instructor of th Dominion Government Penitentiary at Edmonton, Alberta, was sorely perplexed because of the way in which certain portions of the cement floors in the institution were wearing away. Restless convicts who were given to pacing to and fro in their cells wore deep depressions in the cement. In the corridors, too, the floors showed very noticeable wear after they had been used only a few months. Every time the floors were swept, large quantities of sand were gathered up, and the dust in cells and corridors was very obnoxious. The Chief Trade Instructor had superintended the mixing of the concrete and the laying of the floors; and he knew that the fault lay not in the quality of the cement. Try as he would, he could not account for its apparent softness. One day, not long ago, the Chief passed through the corridor of the main cell block when the convict cleaners were scrubbing the floors. He noticed that they used a very strong solution of creosote for cleansing and disinfecting, pouring it ahead of them with their brooms. Suddenly it occurred to him that perhaps it was this creosote that was playing such havoc with his perfectly good floors. He resolved to experiment, and made two plates, of the same proportion of sand and cement as was used for the floors. One of these he treated with creosote diluted in water, administering the mixture several times during the day with a brush. The other plate was left untouched. The following day he took up the two plates, and with his knife was able to scrape off large quantities of sand and cement from the surface of the plate that had been subjected to the creosote. In fact, it was so soft that one could make holes in it with a sharp stick. The other plate was, of course, hard and in perfect condition. Needless to say, the use of creosote as a cleanser and disinfectant for the cement floors and walls was abandoned immediately.

An architect figures as the chief character in the Russian dramatist Leonidas Andreiev's play. "The Life of Man," which has been produced at the Lyceum Theatre, Edinburgh, for the first time outside Russia. It is not a cheerful play. Briefly, the dramatist endeavors to recount the life of a man from cradle to grave in an atmosphere highly charged with symbolism and thickly populated with mysterious Hims and Its. Before the man is born, Life speaks his prologue. During the process a group of old women mow and chatter and cynically chronicle the travail of the mother. As the child is born a candle is lit—in due course to be snuffed—in the hand of Life. The Man's life follows thereafter in four stages. In the first he is living on love and dreams with a charming wife, while he fails to "arrive" as an architect. This lovemaking is described as quite the best thing in the play, for its beauty is heightened by the brave challenge of Poverty and Destiny which breathes through the young people's talk. In the next stage the Man has "arrived." But his success and the cringing suitors who chase love from his home are rather sketchily drawn. Andreiev is happier in showing the return to poverty, through a change in the popular taste in architecture. Henceforth he piles up calamity with characteristic ardour. The Man's only child dies, and he himself becomes a dipsomaniac. The last stage shows his end in a delirious death-bed.

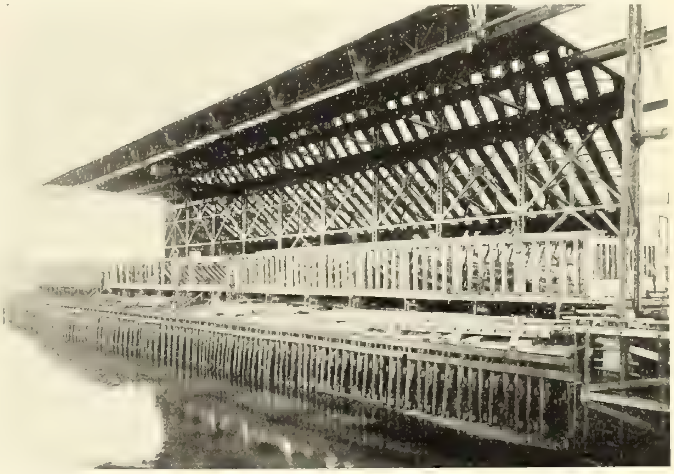
Prince Rupert's Great Floating Dry Dock, Now Nearing Completion

COMMENCED in April, 1912, it is expected that the Grand Trunk Pacific floating dry dock at Prince Rupert, B.C., will be finished in September or October next. The port has made great progress of late, and there are now three first-class rail services a week from Winnipeg to Prince Rupert. Doubtless this development will be still more marked when the dry dock is completed. The dock is being built by the Grand Trunk Pacific Railway Company at an estimated cost of $2,500,000.

The land and wharf area is 17 acres. The dock is in three units, the extreme length of the dock over all being 600 feet, with a lifting capacity of 20,000 tons. The middle section is 270 feet long, with a lifting capacity of 10,000 tons, and the two end sections are each 165 feet long, with a lifting capacity of 5,000 tons each. In addition to the units with steel wings, there are twelve wood pontoons. The latter are removable and self-docking. This feature allows of the use of two or more pontoons for salving wrecks, under certain conditions, or enables three ships to be docked at once, as each section works independently. The combination of wooden pontoons and steel side walls or wings is believed to furnish the most durable, as well as the most economically maintained, floating dock. The pontoons being wet all the time, the timber lasts indefinitely, unless attacked by marine borers, but this danger is carefully guarded against. The wings, being wet and dry alternately, must be of steel. The pontoons are of lumber, sheathed with four layers of felt, a layer of galvanized sheet iron, and an outer layer of creosoted planking. Each layer is swabbed with a mixture of pine tar and arsenic, which makes it safe against toredo.

The entire dock, which has a draft of 30 feet over the blocks, can be pumped out in one and a half hours. The plant is equipped with the most modern machinery, including on the dock three air compressors of 500 cubic feet each, and twelve 24-in. centrifugal pumps, electrically driven. The ship shed is equipped with two 10-ton travelling cranes. A fifty-ton shear leg derrick is on the dock, and can be used for handling boilers and heavy machinery in and out of ships.

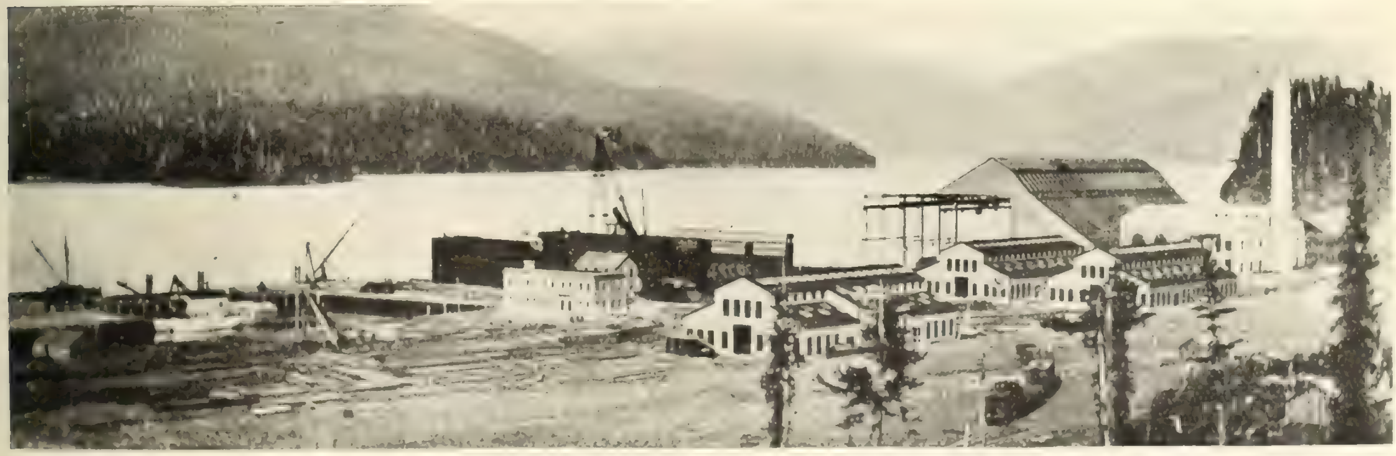
The power house, which is 104 x 148 feet, is constructed of steel and concrete, and contains two 1,000 kw. turbine generators and a large air compressor. A system of underground electrical conduits has been installed throughout the shipyard, as well as compressed air lines. About 2,600 h.p. will be developed. The power house will contain six 400 h.p. water tube boilers supplied with automatic stokers, chain grate type, such as are known to give satisfaction with Pacific Coast coal. The air compressor (steam driven) is of 1,500 cubic feet capacity.

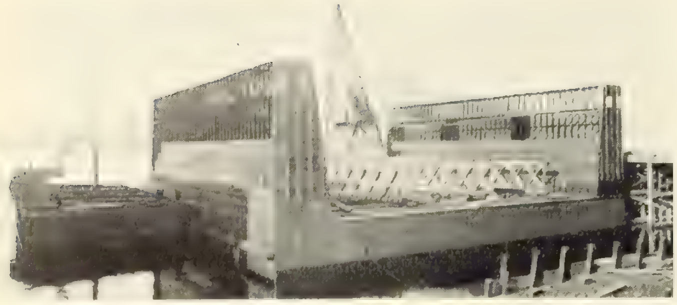

G.T.R. dry dock at Prince Rupert, B.C., showing pontoons 10, 11 and 12 under construction, under shipbuilding shed. Each pontoon is 130 feet long. Note the 80 ft. overhang of shed, which carries two 10-ton travelling cranes, electrically-operated.

Besides the dock proper and the power house, there are foundry, 75 x 150 feet; machine shop, 75 x 150 feet; boiler and blacksmith shop, 75 x 150 feet; shipbuilding shed, 160 x 300 feet; side launching platform, 440 x 80 feet. The chimney on the power house is 175 feet high by 11 feet diameter.

Each shop and the power house is equipped with a 15-ton electrical overhead crane, while the ship shed has wood-working machinery, and also overhead cranes arranged to build vessels under cover over permanent launchways.

The following is a list of the machinery in the machine, boiler and blacksmith shops:—Pond engine lathe 76 ins. x 62 ins., engine lathe 42 ins., double


General view of the Prince Rupert dry dock.



G.T.R. dry dock at Prince Rupert, B.C., showing a portion of the middle section of floating dry dock under construction. Its lifting capacity will be 20,000 tons.

angle shear, engine lathe 26 ins. D.B.G., heavy vertical drill 30 ins., tool makers' lathe 16 ins. x 10 ft., Cox pipe threader 6 ins., style "F" Yankee Drukk grinder, Acme single bolt cutter 2 ins., 4 Fisher & Morris anvils 300 lbs., 4 sets B.S. hand tools, 2 LeBlond B.G. engine lathes 18 ins. x 10 ft., Arm Mouller radial drill 3 ft., Niles horizontal milling machine, Niles boring mill 10 ft., LeBlond No. 4 Universal milling machine, planer 72 ins. x 72 ins. x 20 ft., B.G. crank shaper 24 ins., Universal radial drill 6 ft., No. 3 single punch, No. 3 single shear, vertical drill 25 ins., plate planer 16 ft., 4 Buffalo Forge No. 0-C, double punch and shear No. 6, Niles flanging clamp 14 ft., S. F. steam hammer 1,200 lbs., and set No. 4 Niles bending rolls.

The material used in the construction of the dock was:—Lumber in 12 pontoons, 4,000,000 feet; galvanized fastenings in pontoons, 400 tons; weight of each pontoon, 490 tons; lifting capacity of each pontoon, 1,700 tons; bolts and spikes, 360 tons; steel in wings of dock, 2,400 tons; rivets in dock, 500,000; white pine wedges for caulking pontoons, 800,000; paint on wings of dock, 13,000 gals.; fireproof roofing, 130,000 sq. ft.; lumber in wharf, 3,000,000 feet; piling in wharf, 268,000 lin. ft., and filling in yards, etc., 303,000 cu. yds.

By August 1st next the dock will be in a position to use a portion of the plant including the 50-ton derrick, machine, boiler, shipbuilding shops, and foundry, and enough of the floating drydock to handle a ship 450 feet long of any tonnage.

The engineers who designed the dock and who are in charge of construction are Messrs. Frank E. Kirby and Wm. T. Donnelly, of New York, with Mr. J. H. Pillsbury, of Prince Rupert, B.C., acting as their local representative on the work. Mr. Chas. N. Crowell, of Prince Rupert, is general manager and superintendent of the drydock.

G.T.R. dry dock, Prince Rupert, B.C., Administration building completed.

Removing Stains from Stonework

In the first place, it cannot be insisted upon too strongly that no stone now accepted as a standard in the market contains within itself the elements of staining or discoloration. It may change its color somewhat in weathering, but this will be in the way of a mellowing of tone, and will give no unsightly blotches. This is proved by the natural exposure of the rock in the quarry. Where there is staining in the walls of a building, it can safely be set down to faults in the setting, or to some cause extraneous to the stone itself.

The most prolific source of trouble, says a writer in "Stone," is, of course, the cement that is used in setting the stone. Ordinary Portland cement will badly stain almost any stone. Various so-called "non-staining cements" are widely heralded, but it is the universal experience of stonemen that little dependence can be placed on these. In the old days, before cement was so widely used, architects rarely had to complain of staining. There are thousands of buildings that have stood for half a century or more that show only the kindly mellowing of time, save for the effect of smoke and dust incidental to city life.

Architects will specify very particularly that stone be set in cement mortar and think that they guard against all trouble if they require the back and sides of the stone to be coated with waterproof paint. Undoubtedly a good paint is much protection, but the difficulty is to coat the beds and joints of each stone clear to the face. A narrow strip left unpainted will permit the carrying of the discolorating moisture from the cement to the face of the stone by capillarity.

All of this trouble could be avoided if the architects would only insist that the stone be set entirely in lime mortar, made in the following proportions: one part lime and three parts sand. The lime to be thoroughly slaked and the sand well tempered; all mortar to lie in the pile at least twenty-four hours before using; all sand to be clean, coarse, and free from loam. If the most delicate stone is set in mortar as above, and the back of the stone plastered with the same mortar, it positively will not stain. There is another way in which stone may be stained—by the drippings from concrete floors or roofs. In such cases the discoloring moisture runs down the face of the stone, and no painting of the back or beds can afford any protection. The utmost care in superintending the construction is the only safeguard from this disfigurement.

Cement stains cannot be eradicated by any wash or other treatment. Fortunately, they are apt to bleach out in time under the influence of the sun and the weather. The architect and the owner alike are naturally greatly exercised when cement stains appear, and try to seek some immediate remedy. The only thing to do is to have patience and wait for the natural bleaching, which may take weeks or even months. The stone setter, anxious to leave a building in spick and span condition, may suggest that it be washed down with muriatic acid. This should never be permitted. The acid may take out some of the stains for the moment, but it burns the surface and eventually will discolor even those portions that escaped the original staining.

There was a time when scrubbing with wire brushes was permitted, but this has generally been discarded, since its bad effects have been recognized.

It is impossible to use wire brushes without leaving a coating of iron on the surface of the stone, and this is bound to leave a worse stain than it corrects.

The sand blast is sometimes employed, but generally for old buildings that have become discolored from smoke and soot. This method should always be discouraged. The sand strikes the stone with a tremendous impact. It destroys the "skin" which forms on the surface of the stone by deposition of mineral ingredients on the evaporation of the interstitial water. It also stuns the grains or crystals of the stone and tends to hasten the weathering.

The very best treatment of stone to remove smoke, soot, dirt, mortar, etc., is a simple washing. A recipe that is recommended by stonemen of the widest experience is as follows: prepare a wash of soft water and about one and one-half bars of common laundry soap. Boil until the soap has been thoroughly dissolved. Add a fine, clean, gritty sand (white preferred) and mix to about the consistency of putty. While mixing add about five tablespoonfuls of ammonia to a bucket of water. With this preparation scrub the surface with a stiff scrubbing brush, wash down with a stream of water from a hose, and then go over it again with a scrubbing brush.

While any building may need a cleaning, a great deal of the staining could be avoided if more care were taken. While speaking of the evil effects from cement and the dripping of dirty water, there are other things to be guarded against. The rust from improperly protected iron or steel and the verdigris from copper or bronze sheathing have disfigured many a fine structure. The writer knows of one very costly building where the oil-saturated exhaust steam from hoisting engines was discharged directly against the facade. What wonder if this is permanently stained? Doubtless the architect is speculating as to the cause of the discoloration, and is inclined to blame the stone.

The Design of School Buildings, with Special Reference to the William Whyte School at Winnipeg

Specially contributed by Col. J. B. Mitchell, Commissioner of School Buildings, Winnipeg

THE planning of modern public schools has been standardized probably to a greater extent than any other type of building, but the programme of school routine (which may vary in each community) really determines its general layout. The location of offices, toilets, etc., the connections and the grouping of special departments, become more or less automatic. In Winnipeg, the conditions which the School Board has had to face for several years—that of providing accommodation for an annually increased attendance of over ten per cent. (reckoning in accurate daily averages as shown by the rolls), has resulted in the adoption by the Board of certain definite principles in regard to the planning of new schools. During the past year, three splendid new schools have been added to Winnipeg's list. These buildings are of the most approved design—both in regard to construction and equipment, and testify to the established policy of the Board to provide the best of everything for educational purposes.

The class rooms are designed to accommodate a maximum of fifty pupils, and follow the same general scheme in all schools. They range in size from 25 ft. x 33 ft. to 26 ft. x 35 ft., according to the size of desks which are to be used, senior classes requiring the larger desks, individual desks being used. The door is always at the right-hand front corner of the room, near the teacher's desk, and a 4-ft. wide wardrobe, for the children's clothes, runs across the rear of each room. Access to this wardrobe is only provided from the class room through arched openings, one at either end. There is no door communicating directly with the corridor. Blackboards of best natural slate extend along the front and right-hand walls. The rooms are so arranged that the light enters over the pupil's left shoulder, and generous transoms of prismatic glass carry light to the side of the room remote from the windows. Artificial light for evening work is provided by sixteen 40-watt bowl-frosted Tungsten lamps, evenly distributed over the entire ceiling area, and controlled by two separate switches, thus giving two intensities of illumination. The floor heights are uniformly 12 ft. 10 ins., which allows two equal flights of eleven 7-in. steps between floors. The main corridors are of liberal width, approximately fourteen feet wide.

Every possible precaution is taken against fire, no wood entering into the construction of the school, other than window and door frames and interior trim. The bearing walls are of brick, the partition walls are of metal lath and plaster, and all floors are of reinforced concrete. Access to the different floors is provided by iron staircases enclosed in fireproof stairhalls, which are separated from the main corridor by copper-covered firedoors, with wire plate glass panels, and transoms. The roof is of slow-burning mill construction, on steel trusses, and is covered with asbestos shingles. When buildings are three storeys in height, two metal spiral fire-chutes are provided, one on either side of the building, the doors to which, on each floor, are fitted with anti-panic bolts, red lights in the corridors indicating the fire exits. Two fire-hose cabinets are located on each floor in a prominent place ready for instant use.

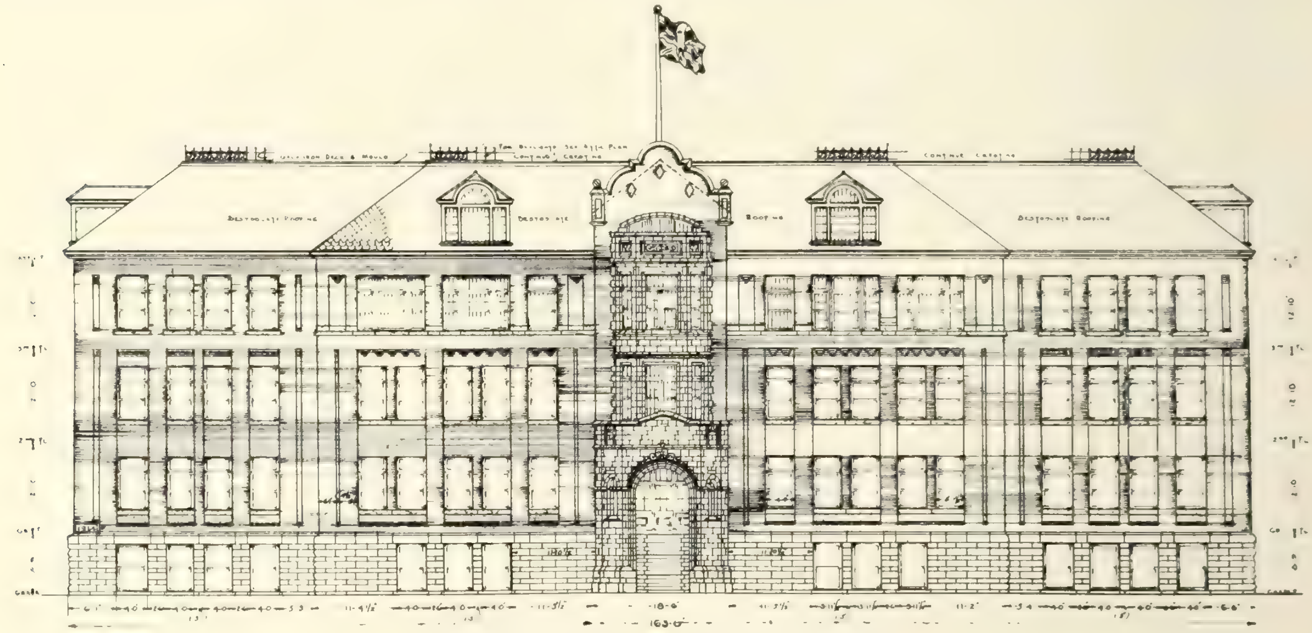
Among the most important sanitary features of Winnipeg schools are the floors, which are of jointless composition throughout, a cove base of the same material carrying eight inches up the wall in all cases. In the toilet rooms, this base is continued to a height of five feet, thus forming a smooth, clean dado. There is practically no place in the building where dust can collect. All the doors are of the flush veneer "slab" type with trim on only the class-room side of the openings, the jambs and soffits elsewhere being bullnosed to die on the frame which is finished with a suitable mould. Metal picture mould, finishing flush with the plaster, is installed wherever desirable.

Lavatories and toilets for both boys and girls are distributed in the basement and on the second floors, while those for use of teachers are in private rooms off the offices. The toilet fixtures include wall-outlet and floor-outlet water closets, operated by flush valves, and individual porcelain urinal stalls, which are of the upright type, with floor outlets, and are provided with concealed metal flush tanks of 4-gallon capacity, arranged to flush automatically every three minutes.

All fixtures are separated by means of slate partitions on metal framing, and are locally vented by exhaust fans. Porcelain hand-bowls, with self-closing cocks for hot and cold water, are installed, and in the basement are located shower baths for both sexes. On each floor are two drinking fountains, each with four outlets—controlled by push buttons.

Besides lighting and power, the electrical contract calls for a complete system of clocks and bells operated from a central station. The master clock, which is situated in the lower halls, is equipped with a pilot clock, which controls all the secondaries, and with a programme to operate the bells which announce the periods for all lessons, races, lunch hour, etc., during the day. The Principal's office has telephonic communications with all the rooms, but there is no intercommunication between the rooms.

For convenience and thoroughness in cleaning the building, a two-sweeper vacuum cleaner, of the rotary-valve type, with wet separator, is installed. Electrically driven by a 7½ h.p. motor, this machine has capacity to exhaust 40 c.f.m. of air from each outlet (the hose being attached) while maintaining a vacuum of 12 inches mercury. Compressed air may be generated by reversing the action of the motor through a two-throw switch. An "unloading" device, which compensates when only one sweeper is used, ensures the economic operation of the plant.


Front elevation, William Whyte School, Winnipeg.

All rooms are warmed and ventilated by fresh air taken directly from the outside, which is first tempered by being passed through heating coils, then washed by passing through the air washer, then through the reheating coils into the fan, whence it is distributed equally to the rooms. The heat in the rooms is supplemented by direct steam radiation. The steam is generated by two low-pressure boilers, with gravity return. Condensation in the case of basement radiation and the heating coils is drained into a common receiver fitted with a float switch operating a motor-driven pump, which returns the condensation to the boilers.

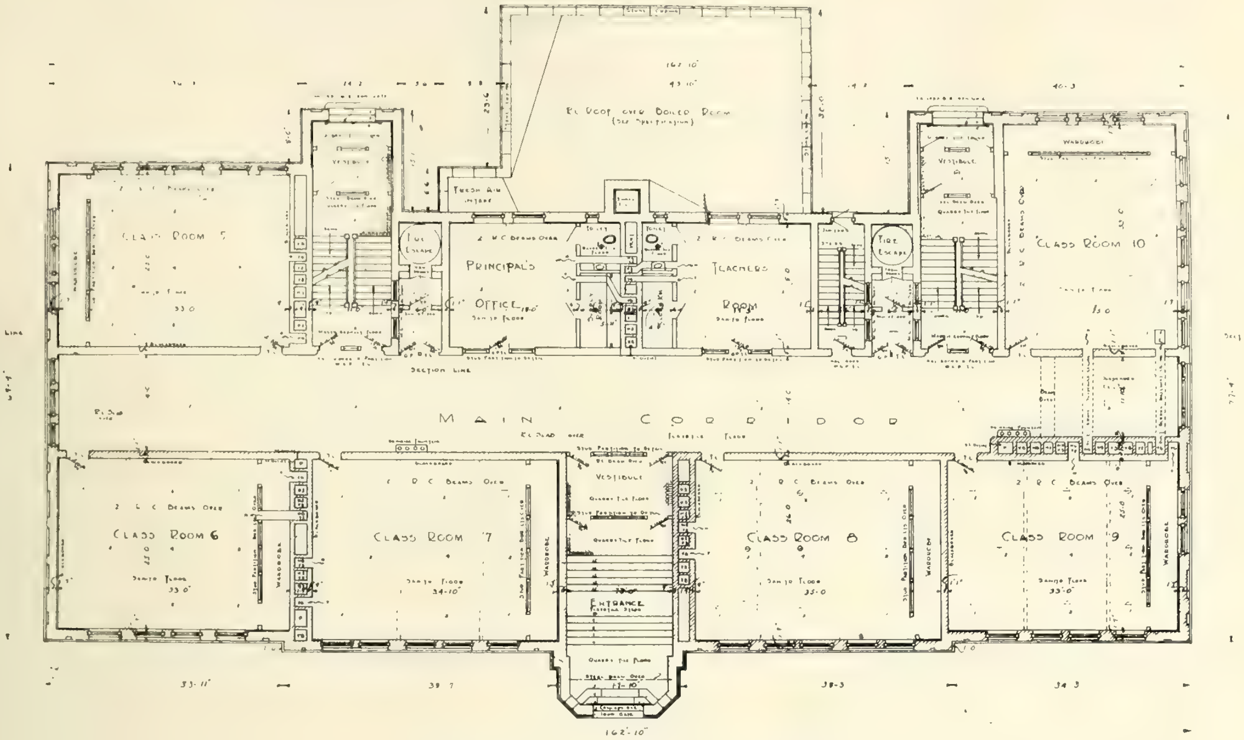
An automatic thermostatic system is connected with and controls the temperature of the coils and radiation. The roof dampers, which control the escape of all vitiated air, are opened and closed by the same system. Exhaust fans take care of all foul air from the toilets and lavatories.

Steam is not used as the motive power for the different apparatus, for two reasons. In the first place electric current in Winnipeg is very cheap, and secondly, high pressure plants are not operated as economically as low-pressure, and a low-pressure system would not drive machinery. There are no register faces on the outlet vent openings which are at floor level, but the floor and base are carried into and around, and the wall above is plastered and painted exactly like the dado in the room. With this arrangement, the presence of any dirt is at once apparent, and there is no difficulty whatever in removing it entirely. In all cases the heat openings are located near the ceiling and have vertical deflectors of galvanized iron, covered with a mesh wire guard, all painted to match the wall of the room.

The total accommodation provided by the three new Winnipeg schools is as follows:—King Edward No. 2, 1,000; William Whyte, 1,000; Earl Grey, 1,500; total, 3,500.

Of these schools the William Whyte (while following the general principles of design described above) has several particularly attractive features. In plan it is practically rectangular, measuring 164 feet by 65 feet. The cornice at the attic floor level is 50 feet above the finished grade line. The three upper floors are faced with buff sand-lime brick of local manufacture, laid up in red mortar, and rest on a 9-ft. plinth of rock-faced Tyndall stone (in alternate wide and narrow courses) which forms the basement storey. All exterior walls are lined with hollow brick on edge, and are waterproofed below the grade by cement and "Ceresit." Stone is also used for window sills, belt courses, and other exterior trim, in which capacity it harmonizes with the general color scheme and relieves the monotony of any large wall surface. The pitch roof, which forms the attic, is bell-shaped, covered with gray asbestos shingles laid "diamond pattern" and finished with a substantial cornice projecting two feet from the wall.

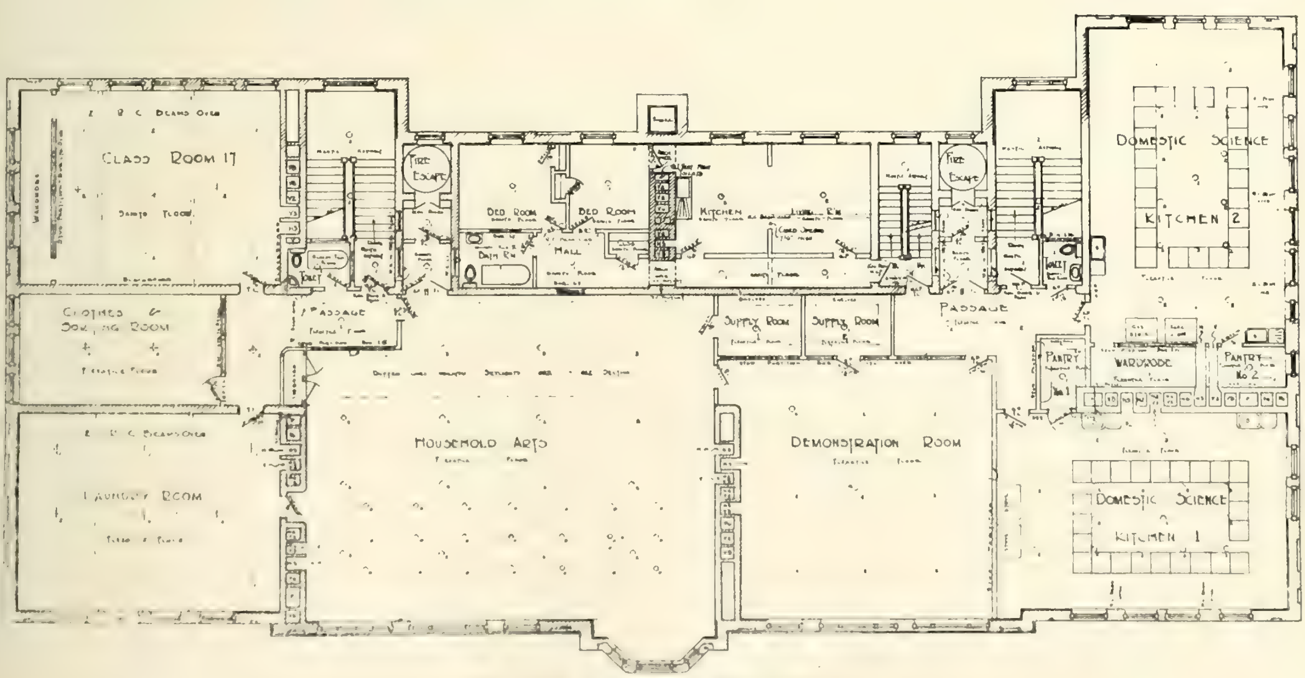
The interior walls and ceilings are plastered and covered with waterproof paint on the upper floors. In the basement special damp-resisting paint is used.



Ground floor plan, William Whyte School.

The whole has an "egg-shell" finish. The ceilings are white, softened with the merest suggestion of green, so as to reflect the light without offending the eye. The upper walls are a light cream, and the dado, which is in constant danger of being soiled, is made quite dark—green in most cases. These colors were selected as being the most practical to use, in view of the danger of "burning," which invariably manifests itself in new walls. The floors are light brown in the centre, with a border and base of rich warm red, which reaches up to the green of the dado. The rather dark fumed effect of the oak trim harmonizes with the general scheme.

In addition to the seventeen rooms where regular classes are conducted, there are special departments for girls, located on the third floor, where they do not interfere with the rest of the school, and where they are easily accessible to the older pupils and to pupils from outside schools. This special unit includes two domestic science kitchens of twenty-four tables each, equipped with individual gas cookers, besides gas and electric ranges, a large sewing room—including one



Third floor plan, William Whyte School

hundred and twenty individual lockers, a demonstration apartment for instruction in household management, together with a laundry having twelve tubs, ironing boards, mangle, clothes drier, etc.

In accordance with the Board's policy regarding the larger schools, a caretaker's quarters has been provided on the third floor. This apartment has a separate entrance, and separate stairs, and is equipped with an electric clock, a telephone to the principal's office, and a vacuum cleaner outlet similar to the rest of the building.

The total cubic contents of the building are 884,650 cubic feet. The contract price, exclusive of heating and ventilating, was $121,640, and the cost of erection worked out at $13.75 per cubic foot. The contract for heating and ventilating was awarded at the figure of $16,570, and worked out at $1.87 per cubic foot. The total unit cost was $15.62 per cubic foot.

Dealing with these figures in another manner, the total cost, including heating and ventilating, was $138,210. Twenty-four rooms, costing $138,210, worked out at $5,759 a room, and, with fifty pupils to a room, at $115 a pupil. Five per cent. of this $115 gives an annual cost of $5.75 per pupil for accommodation.

These prices compare favourably with those for schools of a similar type erected elsewhere in Canada and the United States. In Boston, twenty-two buildings average a unit cost of 22 cents per cubic foot, and in St. Louis eight schools show an average cost of 17½ cents. Similar buildings in Montreal cost about 20 cents per cubic foot.

In conclusion, may I be allowed to express the opinion that no public money spent in Canada is productive of such beneficial results as the money spent in providing the girls and boys of to-day (who in a few years will be guiding Canada's destiny) with a proper education. In this, first-class school buildings have an appreciable effect.

Gravel is about the only hard-surfacing road material Iowa has, and an experimental two-course water-bound road 1¼ miles long of that material will be built this year in Webster County just east of Fort Dodge. The road is for the purpose of testing out the gravel along modern lines to meet hard-surfacing conditions. It is to be a joint affair participated in by the city, county, State Highway Commission and good roads section of the Engineering Experiment Station at Iowa State College. The road will be 16 ft. wide, 8 ins. thick in the centre and 6 ins. at the sides. Frequent tests will insure the proper proportions of gravel and clay binder. A coat of oil will probably be applied one or two months after construction has been completed.

At the recent sitting of the Dominion Railway Board in Vancouver an application was made for an order directing the Vancouver, Victoria & Eastern Railway to commence the construction of freight and passenger terminals on False Creek, as provided for in the agreement entered into between the city and the railway company on May 16, 1910.

Amendments recently made to the building by-laws of the city of Victoria effect a substantial restriction in existing fire limits, and also the right to effect repairs. Hereafter new work on a building damaged by fire within the fire limits will be limited to 25 per cent. of the value of the structure.

The Use of Large Stone Chips in the Maintenance of Bituminous Roads

THE Maryland Highway Commission, of which Henry G. Shirley is chief engineer, after an experience with the maintenance of bituminous roads extending over several years, has (says our Chicago contemporary, Engineering and Contracting) adopted the practice of using stone chips at least 1 in. in size. The chips are spread over the surface of the road, at seasons of the year when the bitumen is soft, in an even layer one stone thick, and rolled. The rolling forces the stones into the surface of the road until they are flush with the pavement. When completed the surface has somewhat the appearance of a mosaic. Hard blue limestone is used, and has been found to be quite satisfactory for this purpose.

The reason for the method of maintenance adopted is obvious. It has been universally found in practice that small stone chips are either quickly ground to a powder by iron-shod traffic or are in a large measure swept from the road surface by automobile traffic. The use of sand is now quite generally avoided by maintenance engineers, on the ground that it tends to build a mat or pad that becomes unmanageable when thick, and also greatly increases the danger of waves in the pavement due to the pushing of the bituminous surface occasioned by the continual passage of automobiles, usually travelling in a single direction on one side of the road.

While this method of surface maintenance—or, more properly, surface improvement—is not new from an experimental standpoint—similar work having been done by Major Crosby, the former engineer for the commission—its application to road maintenance work on a large scale, such as is in progress in Maryland, is an innovation. From the standpoint of the road user it possesses advantages. The exposed stones roughen the surface and reduce the slipperiness of the pavement. Slipperiness has always been a fault of biutminous treated country roads, especially since many of the horses that travel them are not sharp shod. The danger of automobiles skidding is also reduced. From the standpoint of increasing the life of the road the reduction in slipperiness permits the use of a relatively higher crown, thereby insuring thorough drainage of the surface and increasing the durability of the road, the practice of most road engineers being to use as much crown as limiting conditions will permit. In this connection it may be said that experience has demonstrated in the city of Washington that asphalt streets and roads built with a high crown have usually a longer life than those streets or roads on which less crown is used.

While the labor cost of applying large stone chips in this manner is necessarily increased somewhat, the road surface is improved by the thorough ironing out it is given by the roller. The greater availability of the supply of larger stone is also a factor worthy of consideration in many sections of the country. It is frequently difficult to secure an adequate supply of ½-inch and ¾-inch stone.

It is believed that the incorporation of large stone chips into the surface of the road is worthy of the consideration of engineers engaged in both maintenance and construction work. While difficulties are encountered and careful workmanship is required, the results obtained are of sufficient value to warrant the additional cost.

The Dominion Observatory, Little Saanich Mountain, Victoria, B. C.

THE building and dome to contain the great 72-inch reflecting telescope, which is to be located near Victoria, B. C., is to be built entirely of steel, cased inside and out with sheet metal. There is to be a continuous passage between these inside and outside coverings to allow for the circulation of air, the entrance being through openings at the bottom of the building and the exit through louvred openings at the top of the dome. The purpose of this ventilating between the walls is to keep the middle of the dome during the day at the shade temperature, thus preventing the heating of the interior and the disturbance of the form and definition of the mirror by great changes of temperature. The purpose of constructing the building and dome entirely of metal is to allow the whole surrounding of the telescope to rapidly attain the air temperature after sundown. Otherwise, the definition of the star images is seriously affected.

The building is 66 ft. in diameter and nearly 75 ft. high, the centre of motion of the telescope being about 40 ft. above the ground. The dome is revolved by electric motor, and the entire handling of the telescope, whose moving parts weigh 40 tons, is also performed by electricity; seven motors and numerous electric clutches being required for this purpose. The shutter opening is 15 feet wide, extending 6 ft. beyond the zenith. An electrically operated observing platform, to enable the upper end of the telescope tube to be reached in any position, moves up and down in the shutter opening. Blinds or wind screens are also provided, moving up from the top to prevent the shaking of the telescope by the wind.

"Don'ts" in Rock Excavation

THERE seems to be a tendency among shovel men, when digging rock, to make the shovel "bite more than it can chew," in other words, to try to force as big a move as possible. This is a mistake for several reasons.

In order to make an extreme move it is necessary to dig with the handle run out practically to the end. In rock work the twisting stresses are great and although a shovel will stand up to it for a while, a breakdown is very probable, due to the strains caused by hard digging in this position.

A shovel does not exert its maximum power with the dipper run out as far as it will go. Furthermore, there is much more strength when the dipper is kept in as far as possible.

When an operator tries to stretch things and make a big move he often gets the front of the shovel so close to the face that in attempting to get the dipper back he will frequently batter the front end of the car-body to pieces, pound the circle, and often cut the swinging cable.

Don't try to make too big a move in rock work.

Don't run the shovel up too close to the new face.

Don't dig with the handle run out to its end.

Saving in one way sometimes involves expense in other ways that more than offsets the prospective gain. The president of a prominent construction company states that in one case the saving of concrete by reducing the size of columns on successive floors was $2.30 per column. On the other hand, the increase in form cost was $5.70 per column, entailing a loss of $3.40 per column. This is a very good example of why it is cheaper to use the same size columns on successive floors than to reduce the dimensions. One way to avoid frequent changes in column sizes is to vary column reinforcement in successive storeys.

Personal Mention

Mr. W. S. McGibbon has been appointed Town Engineer of Transcona, at a salary of $2,000.

Mr. Frank McArthur, City Engineer of Regina, has been appointed City Engineer of Guelph, at a salary of $2,500 a year.

Mr. W. R. Butler, for the last eighteen years Professor of Civil Engineering in the Royal Military College at Kingston, Ont., has retired from active service.

Mr. F. L. Brinkman, formerly Assistant Engineer of the city of St. Thomas, Ont., has been appointed Assistant Resident Engineer in the Department of Public Works at Fort William, Ont.

Mr. Rudolph Hering, of Chicago, paid a visit to Victoria recently, after a tour of the San Francisco Exposition. It is recalled that as long ago as 1891 Mr. Hering was called in by the city of Victoria to report on the trunk sewerage scheme.

Mr. Hurlbut S. Jacoby, formerly Chief Engineer of the Standard Steel Construction Company, of Welland, Ont., and recently appointed Instructor in Civil Engineering at Pennsylvania State College, has been retained as Associate Engineer for summer work by the Samuel Austin & Son Company, industrial engineers and builders, of Cleveland, Ohio.

Mr. C. H. Mathewson, engineer in charge of the harbor improvements now being carried out at Toronto by the Dominion Government, was presented with an electric lamp and a gold fob by the sub-engineers and inspectors employed on the works at a meeting of the South Toronto Conservative Club, Simcoe Street, last week. The lamp was made from the first piles driven, and the fob was modelled to represent a "pile." Mr. Mathewson succeeded Mr. J. G. Sing as engineer in charge of the work, he having been promoted from the position of senior assistant engineer.

Book Review

Manual of Surveying for Field and Office, by Raymond E. Davis, C.E., Instructor in Civil Engineering at the University of Illinois. Published by the McGraw-Hill Book Company, Inc., New York City. Price $2.50.—This book is a manual of the practice of surveying designed for the use of civil engineering students in their preparation for field and office exercises. Primarily it is intended for use in conjunction with a treatise on surveying if the field and office practice is developed with the theory, or for use alone if practice is given after the theory has been studied. The book is also adapted for use in short elementary courses in surveying, in which the time devoted to field and office work is comparatively long, such as the courses usually given to mechanical and electrical engineering students. The aim in the preparation of this volume has been to provide an efficient means of teaching students the proper use of surveying instruments, the proper procedure in making surveys, and the proper methods of computing and mapping. The practical phases of the subject are discussed in great detail.

Mainly Constructional

East and West From Coast to Coast

The corporate name of the Montreal Paint and Glass Company, Limited, has been changed to C. A. Sharpe, Limited.

Creditvale Works, Limited, is a new machinery manufacturing firm to receive a charter. The concern is capitalized at $100,000, and the head office will be at Toronto. G. W. Hammond, patent solicitor, of Toronto, is one of the incorporators.

The Vacuum Street Cleaning Machine Company, Limited, of Windsor, Ont., has been incorporated with a capital stock of $175,000. The company will carry on the manufacture of street sweepers, cleaners and dusters, air cleaning and drying apparatus, and all incidental machinery. The incorporators include W. T. Blaney, of Windsor, Ont., G. S. Clarke, and J. A. Corrick, both of Detroit.

The Page-Hersey Iron, Tube & Lead Company's plant at Guelph, Ont., which has been running short-handed for some time, is starting up again with a full staff. The number of men employed has been about forty, but this is now being increased to one hundred and fifty. The company will manufacture the same line of iron pipe as formerly. It is stated that they will also operate a galvanizing plant.

The Missisquoi-Lautz Corporation, Limited, Montreal, have the following contracts in hand: marble and tile for the Ottawa Examining Warehouse, of the value of $76,500; marble for the St. Denis Theatre, Montreal; for the Redemptorist Church, Quebec; for the Post Office, St. John, N.B. The company's marble is also specified for the Montreal civic library and for the new C. P. R. station at Quebec.

An early start will be made on the new railway terminals at Toronto, according to information from Ottawa. It is stated that an arrangement has been made for advances of $4,000,000 by the Bank of Montreal on the guarantee of the Canadian Pacific and the Grand Trunk Railways, and that all details have been worked out, including the arrangement with the Government in regard to the question of a postal station. Contracts for the work were awarded about a year ago, but the financial disturbance created by the war necessitated a postponement of all arrangements, including those relating to financing. The P. Lyall & Sons' Construction Company was the successful tenderer for the larger portion of the work.

The New Toronto Council have definitely decided to link up with Mimico and construct a sewage system and disposal plant which will accommodate the needs of both municipalities. The disposal plant will be built in Mimico. The pumphouse, a portion of the new works, will be constructed at the lower end of Superior Avenue. The cost of the new system will amount to about $50,000, according to the estimates of the engineers. Of this amount New Toronto will contribute half. No time will be lost in starting operations. It is hoped to have work in full swing by the middle of next month. According to the present plans part of the New Toronto system will be utilized and all sewage will drain to the Lake Shore Road, where a 36-inch main will connect with the plant at Mimico.

Work is progressing rapidly on the various stretches of highway now being built by the Good Roads Commission, and gangs are now engaged reconstructing Main Street, Weston; Main Street, Stouffville; the Kennedy Road through Agincourt, Unionville and Stouffville, and the Vaughan Road in Fairbank and Downsview. Workmen have been busy resurfacing Main Street, Stouffville, and Mr. E. A. James, the Engineer, expects to have the new road open for traffic right away. A new road has been laid on Main Street, Weston, from the southerly limits to Mill Street, and the road will be finished in about three weeks. On the Kennedy Road about four miles of new road is being built at a cost of $35,000. About one and three-quarter miles is being constructed on the Vaughan Road at a cost of about $10,000.

The Public Service Corporation of Quebec is the name of the new hydro-electric company recently incorporated with a provincial charter to supply light and power to the cities of Quebec and Three Rivers and to operate in several adjoining counties. The corporation have, through Mr. C. H. Branchaud, of Montreal, purchased by public auction for $100,000 the assets and contracts of the Dorchester Electric Company, and have contracted with the Shawinigan Water and Power Company for the latter to supply all the power needed. This will involve the building by the Shawinigan Company of a transmission line to Quebec, and it is expected that it will be completed early in the fall. It is intended to overhaul the present steam plant of the Dorchester Company and to use it as an auxiliary. The provisional directors of the Public Service Corporation of Quebec are—Messrs. Howard Murray, T. McDougall, and Julian C. Smith, of the Shawinigan Water and Power Company, and C. H. Branchaud and Milton L. Hersey, directors of the Dorchester Company.

According to information furnished by Mr. J. S. MacLachlan, Superintending Engineer of the outer harbor improvements at Victoria, B. C., the month of June was a record-breaking one in connection with progress made on the breakwater. The wall was completed for an additional distance seaward of 150 feet. The undertaking is being carried out in good order, and by the end of the year the structure will be completed. During the month the contractors for the breakwater, Sir John Jackson, Limited, dumped 24,713 tons of rubble, laid in position 8,815 tons of granite rock, and set 2,042 cubic yards of granite. The total returns since the commencement of the work are as follows: amount of rubble dumped, 659,154 tons; amount of granite laid, 51,228 tons, and amount of concrete set, 11,942 cubic yards. June was a record month for the laying of granite and the setting of concrete. Six blocks of concrete, each block weighing 700 tons, were completed, and this increased the length of the wall 150 feet. Grant Smith & McDonnell, contractors for the new piers, have made good progress. In the dredging operations 16,416 cubic yards of material were removed, a total of 5,330 tons of rubble was dumped and a surfacing of 1,617 cubic yards was deposited. On the cribs 679 cubic yards of filling was used, and 21,607 cubic yards of material for the back of the cribs was set. This brings the total amount of rubble dumped since the operations started to 354,688 tons, and the amount of back filling to 25,475 cubic yards.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Brandon Hills, Man.
Tenders on the construction of a road through the Brandon Hills will be received until July 23rd, by D. W. Shaw, Bank of Hamilton Chambers, Brandon. Plans and specifications at the Municipal Chambers, Bank of Hamilton Chambers, Brandon.

Chambly Basin, Que.
The Secretary to the Municipal Council will receive tenders until 7 p.m., July 26th, for the supply and installation of 34,000 feet of sewer pipe, 800 feet of steel pipe, and two electric turbine pumps, with capacities of 600,000 and 400,000 gallons per day respectively.

Guelph Township, Ont.
The Township Council have passed a by-law providing for the laying of a concrete sidewalk on College Heights. Engineer, E. J. Holland.

Hamilton, Ont.
The City Engineer has recommended that asphalt paving be laid on Spruceside Avenue and Kent Street. City Clerk, S. H. Kent.

Hull, Que.
The City Council are now receiving tenders on the supply of 3,475 feet of 12-inch cast iron pipe, 4,710 feet of 10-inch, 9,425 feet of 8-inch, 8,550 feet of 6-inch, and 64,450 pounds of specials of different sizes. Engineer, J. P. A. Laforest.

Hullet Township, Ont.
Tenders on the deepening of the McCall Extension Drain will be received until 2 p.m., July 29th, by the Township Council. Clerk, James Campbell, Londesboro.

Maisonneuve, Que.
The paving of a number of streets has been decided on by the City Council. Engineer, M. Dufresne.

Millardville, B.C.
The Municipal Council have adopted a scheme for waterworks installation recommended by the Engineer. Estimated cost, $8,175.

Port Colborne, Ont.
The Town Clerk, D. Alair, will receive tenders until 6 p.m., July 24th, for the construction of about 1½ miles of macadam roadway.

Sandwich, Ont.
A by-law for the construction of a quantity of silex sidewalk at an approximate cost of $3,000 will be submitted to the ratepayers on August 7th. Town Clerk, E. R. North.

Thorold, Ont.
Cement sidewalks are being laid on West Mill, Metcalfe, Queen and Albert Streets by day labor.

The Town Council have passed a by-law for the construction of sewers on various streets. Tenders for the work will be called later. Clerk, D. J. Munro.

Toronto, Ont.
The Board of Control will receive tenders until August 3rd for the construction of sewers on Jones and Boultbee Avenues, Queen Street and Kingston Road.

CONTRACTS AWARDED

East Kidonan, Man.
The following contracts have been let by the Municipality:—laying watermains, Nagle & Dunlea, 402 College Avenue, at $9,605; supply of pipes and fittings, Canada Iron Corporation, 147 Bannatyne Avenue, $18,350; valves, T. McAvity & Sons, Ltd., 147 Bannatyne Avenue, $1,287; meters, National Meter Company, 229 Spence Street, $706.

Fairbank, Ont.
The Trustees of School Section No. 15, York, have let the contract for the construction of concrete walks at the Vaughan Road School to A. J. Penberthy, 292 Booth Avenue.

Lachine, Que.
The following contracts have been let by the City Council:—supply of cast iron water pipe, Dominion Bridge Company; sewer pipe, valves and hydrants, Alexander Clement; sand, A. Leclair & Son; stone for macadam and cement, Lapailleur & Frere, 406 St. Joseph Street.

Kent County, Ont.
The contract for the construction of a watermain to the House of Refuge has been awarded by the County Council to James Doyle, 92 Cross Street, Chatham, at $3,500.

Montreal, Que.
The general contract for the erection of a pump building for the Board of Commissioners has been let to Arsenalt & Plamondon, 70 St. James Street.

The following contracts for the supply of paving blocks have been awarded by the City Council:—W. McValley Company, Ltd., 120,000 at $49.25 per M.; Elder Ebano Company, Ltd., 11 Place D'Armes, 460,000 at $48.95 per M.; Webster & Sons, Ltd., 31 Wellington Street, 460,000, at $44.75 per M.; Benoit & Lafonde Granite Company, 30 St. James Street, 410,000 at $1.65 per square yard; Sicily Asphalt & Paving Company, 60 St. Viateur Street E., 410,000 at $1.65 per square yard.

Oshawa, Ont.
A contract for the construction of about 8,000 square yards of concrete pavement for the Town Council has been let to Drew & Flintoff.

Ottawa, Ont.
The City Council have let a contract for laying asphalt pavement to the Ottawa Construction Company, Central Chambers.

Outremont, Que.
The Municipal Council have let a contract for the supply of 280,000 vitrified shale wire-cut paving blocks to A. Bremner, 100 Bleury Street, Montreal, at $39 per thousand.

Ritchot, Man.
The Municipality have let contracts for road grading to D. Carriere, P. Lavallee, A. Delorne, and D. Lagasse, and for the construction of culverts to K. Schioler & P. LaCour, 1114 Garfield St., Winnipeg.

St. Catharines, Ont.
The City Council have awarded the following contracts:—Warren Bituminous Paving Company, 103 Bay Street, Toronto, bitulithic pavements at $2.29 per square yard, and concrete curbs and gutter at 60c. per lineal foot; Newman Bros., 74 St. Paul Street, brick block pavement at $2.35 per square yard, and concrete sidewalk and curb; Creosote Block Paving Company, Royal Bank Building, Toronto, wood block pavement, at $3.05 per square yard.

Winnipeg, Man.
The contract for laying a sewer on Stafford Street has been awarded by the Board of Control to the Dominion Contracting Company, 632 Aberdeen Avenue.

The Board of Control have let the contract for the supply of lead pipe to James Robertson Company, 175 Pacific Avenue, at $9.50 per 100 pounds.

Railroads, Bridges and Wharves

Hastings County, Ont.
Work is about to start on the construction of six bridges by day labor under the supervision of Lucius E. Allen, C. E., Belleville. Material will be purchased by J. A. Gunter, P. O. Gunter, and Mr. Allen.

London, Ont.
The breakwater is being built by day labor, under supervision of City Engineer H. A. Brazier. Approximate cost, $25,000.

Proton Township, Ont.
Tenders on the construction of a concrete arch bridge will be received until noon, July 26th, by W. J. Bellamy, Flesherton, Ont. Plans and specifications with the Engineer, R. McDowall, Owen Sound, and with Mr. Bellamy.

St. Rose, Que.
The Municipal Secretary, Henry Chapleau, will receive tenders until 7 p.m., July 27th, for the construction of a concrete pillar at the Lachapelle Bridge. Plans and specifications with the Secretary.

CONTRACTS AWARDED

Halifax, N.S.
The contract for the construction of a wharf for the Furness, Withy Com-

pany, Water Street, has been awarded to the Nova Scotia Construction Company, 159 Upper Water Street. Reinforced concrete construction. Estimated cost, $200,000.

Hanover, Ont.
A contract for building concrete abutments for a bridge has been let by Road Commissioner D. Willoughby, R. R. No. 2, Elmwood, to Hugh Watt, Chesley.

La Loutre, Que.
The contract for the construction of a storage dam on the St. Maurice River for the Quebec Streams Commission has been let to Joseph Gosselin, Levis. Approximate cost, $1,300,000.

Lunenburg County, N.S.
The contract for the construction of culverts for the Department of Public Works, Halifax, has been awarded to Arthur Hood, Shelburne County, at $5,300.

Peel County, Ont.
The County Council have awarded a contract for the erection of two concrete bridges to Charles Mattaini, Tower Street, Fergus, and for three bridges to H. E. Croft, 113 Cambridge Street, Guelph.

St. Francois Xavier, Man.
The contract for the erection of a reinforced concrete bridge for the Municipality has been let to Buchanan & Hinds, Builders' Exchange, Winnipeg, at $3,100.

York County, Ont.
The County Council have awarded the contract for flooring the Summerville Bridge to the Creosoted Wood Block Company, 2 King Street E., Toronto.

Public Buildings, Churches and Schools

Aroostock Junction, N.B.
Plans of a school have been submitted to W. S. Carter, Chief Superintendent of Education, Fredericton, N.B. Brick construction. Estimated cost, $7,000.

Balcarres, Sask.
Work by day labor is about to start on the erection of a church for the Roman Catholic Congregation. Particulars from Rt. Rev. O. E. Mathieu, D. D., 2107 McIntyre Street, Regina. Estimated cost, $3,000.

Barachois De Malbaie, Que.
Tenders on carpentry, painting and the installation of a heating system at the Church will be received until July 24th by J. C. Plourde. Architect, Thomas Raymond, 43 Charon Street, Quebec.

Forget, Sask.
The Trustees of School District No. 1 have been authorized to borrow $3,700 for the erection and equipment of a school. Treasurer, C. M. Force, Forget.

Indian Head, Sask.
Tenders on the erection of a Forestry Office will be received until 4 p.m., August 9th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications at offices of H. E. Matthews, Superintending Architect of Dominion Public Buildings, Winnipeg, W. T. Mollard, Clerk of Works, Regina, the Superintendent, Forestry Station, Indian Head, and at the Department, Ottawa.

Kentville, N.S.
The plans for a sanatorium, prepared by W. M. Brown, Merchants Bank Building, Halifax, have been found too costly, and new plans will be drawn. Estimated cost, $4,000.

Kingsville, Ont.
Tenders will be called shortly for remodelling the Methodist Church Sunday School. Work to consist of erection of two galleries, other interior alterations and installation of a ventilating system. Architect, T. Jenner, Amherstburg, R. R. No. 1. Approximate cost, $3,500.

Malbaie, Que.
The fixtures and furnishings for the college which has been erected for the School Commissioners of Murray Bay will be purchased by the President, J. E. Maltais, and the Secretary, J. McNicholl.

Orillia, Ont.
Tenders on alterations to heating and ventilating systems are now being received by T. W. Robins, Secretary to the Collegiate Institute Board, Orillia.

Paisley, Ont.
Robert Colwell, R. R. No. 2, Paisley P. O., will receive tenders until July 30th for the supply and installation of a hot air furnace and seating at the School in Section No. 10, Bruce and Greenock.

Perth, N. B.
Plans of a four-roomed frame school have been submitted to W. S. Carter, Chief Superintendent of Education, Fredericton, N. B. Estimated cost, $7,000.

Repentigny, Que.
The erection of a school is contemplated by the School Commissioners. Secretary, J. U. Perrault, Repentigny.

St. Constant, Que.
A school is being erected here at an approximate cost of $5,000. Secretary to the School Commissioners, Lorenzo Letrourneau.

St. Lin, Que.
The School Commissioners are considering the construction of a school. Secretary, J. Archambault.

Toronto, Ont.
Tenders will be received until 2 p.m., July 26th, by the Secretary, W. C. Wilkinson, Board of Education, City Hall, for the erection of additions to the King Edward and Manning Avenue Schools, and for iron fences and stairs, concrete floors, electric work, local telephones and midsummer repairs at various schools. Plans and specifications at office of Superintendent of Buildings, City Hall.

Waterford, Ont.
The School Board have had plans prepared for a High School, and tenders will be called shortly. Approximate cost, $4,400. Chairman, L. L. Sovereign.

Windsor, Ont.
Tenders for plumbing and carpentry work at Mercer and Tuscarora Street Schools are being received by G. A. Courtney, Secretary to the Board of Education.

CONTRACTS AWARDED

Clinton, Ont.
Work is about to commence on the erection of an addition to the Collegiate Institute. The masonry, cement, brickwork and plastering contracts have been let to Prior & Sweet, the carpentry and woodwork contracts to Thomas McKenzie, King Street, the contract for plumbing, heating, roofing and interior fittings to Bryan & Sutter, and for painting to Thomas Crealis.

Gifford, Que.
In connection with the presbytery in course of erection for the parish of St. Ignace de Loyola, the carpentry and plastering contracts have been let to the general contractor, G. Parent, Gifford, the roofing, heating, plumbing and electrical contracts to J. Gagnon, Beauport, and the contract for painting to Charles Roussel, 60 Ste. Ambroise Street, Ottawa.

Halifax, N.S.
Work has been commenced on the erection of a laundry at the Convent of the Sacred Heart, Spring Garden Road, by the general contractors, S. M. Brookfield, Limited, 58 Granville Street. The masonry, carpentry, steel, plastering and painting contracts have been let to the general contractors, and the contracts for heating, plumbing and electrical work to Farquhar Bros., Ltd., Barrington Street. Approximate cost of work, $6,000.

Kingsville, Ont.
The general contract for the erection of an addition to the school has been let by the Board of Education to H. Holt, at $3,375, and for heating work to Scratch & McDonald.

Lakeside, Ont.
Work has been started on the erection of a church for the Methodist Congregation by William Crellin, Kintore. Estimated cost, $7,000. Pews, windows, furnaces, pulpit, etc., will be purchased by Robert Rawlings.

London, Ont.
In connection with alterations to the Baptist Church on Talbot Street, the contract for painting and decorating has been let to W. T. Mossops & Company, 644 Lorne Avenue, and for seating to the Valley City Seating Company, Dundas

Montreal, Que.
The contract for steel work in connection with the erection of a fire escape at the Sherbrooke Street School has been let to the Montreal Architectural Iron Works Company, 157 Prince Street.

Quebec, Que.
In connection with the chapel being built on St. Foy Road for the Sisters of St. Joseph de St. Valier, the plastering, painting, plumbing, heating and electrical work will be done by the general contractor, E. Rochette, 71 Des Stigmates Street.

Scarboro Junction, Ont.
Work will start shortly on the erection of a school in Section No. 10. The masonry contract has been let to H. Webster, Bannington Avenue, and the contract for carpentry to H. Walton, Coleman Avenue. Estimated cost, $8,000.

Toronto, Ont.
Work has been commenced on the erection of an addition to St. John's Church, Kingston Road and Woodbine

Avenue. The following contracts have been let:—masonry, A. Duckworth, 155 Cedervale Avenue; carpentry, W. Williamson, 137 Woodbine Avenue; plumbing, F. Toseland, 304 Kingston Road; lead glass, Luxfer Prism Company, 100 King Street W.; painting and decorating, W. M. Weekes, 37 Wilton Avenue. Estimated cost, $10,000.

The contract for the construction of foundations for the school on Baby Point Road has been let by the Trustees of School Section No. 32, York, to R. Smith, Jane Street.

Valbryant, Que.
Work is progressing on the erection of a Presbytery estimated to cost $15,000. The masonry, carpentry and steel contracts have been let to the general contractor, Joseph Coulture, 19 St. Joseph Street, St. Levis.

Business Buildings and Industrial Plants

Hamilton, Ont.
Tenders for remodelling the Y. M. C. A. Building at 81 St. James Street S. are being received by the architects, Mills & Hutton, Bank of Hamilton Bldg.

Hull, Que.
Work by day labor has been started on the erection of a garage for N. Beaudin, Albion Hotel. Approximate cost, $3,500.

Lake Rush, Que.
The erection of a sawmill is being considered by P. H. Renaud, Agnes Street, Megantic.

Levis, Que.
Plans are being prepared for a drug store and residence to be erected at Commercial and Fraser Streets for Joseph Leblond. Architect, L. Auger, 36 St. John Street. Approximate cost, $8,000.

Montreal, Que.
Mrs. L. Glass, 1467 Garnier Street, is having a shed built at a cost of approximately $7,000.

Tenders on all trades excepting carpentry required in the construction of a coal storage building are being received by Mrs. L. Glass, 1467 Garnier Street. Estimated cost, $7,000.

New Westminster, B. C.
Work on the erection of an elevator and warehouse on Front Street for the Brackman Ker Milling Company will be done under the supervision of F. T. Sherbourne, 2046 Beach Street, Vancouver.

Okanagan Landing, B.C.
The station, roundhouse and turntable which the Canadian Pacific Railway proposed to erect here will not be built.

Ottawa, Ont.
T. Lawson & Son, Limited, have had plans drawn for an addition to their shop and offices on Wellington Street. Brick construction, felt and gravel roofing, concrete foundation. Estimated cost, $4,500.

Quebec, Que.
The contract for heating and plumbing at the Union Station in course of erection at St. Poul and Henderson Streets has been let to Vandry & Matte, 169 St. John Street.

Victor Giguerre, 10 Gosford Street, is erecting a store and residence on Fifth Street, Limilou, estimated to cost $10,000. Brick construction, concrete foundation.

Richards, N.B.
H. Bouday, M.P., Rimouski, is about to rebuild his sawmill, which was recently destroyed by fire. Work by day labor.

Sherbrooke, Que.
The City Council have decided to proceed with the erection of a gas plant at once. Estimated cost, $70,000. Engineer, Thomas Tremblay.

St. Jerome, Que.
The erection of a foundry is being considered by Alfred A. Viau, 7 St. Joseph Street.

CONTRACTS AWARDED

Brantford, Ont.
Work on the erection of a car-barn and sub-station for the Lake Erie & Northern Railway Company, 28 West Mill Street, will be started at once by the general contractors, H. Secord & Sons, Limited, 133 Nelson Street. Brick construction, concrete and brick foundation, felt and gravel roofing. Estimated cost, $3,500.

In connection with the factory erected on Grey Street for the Brantford Computing Scale Company, Limited, the contract for plumbing has been let to J. W. McHutchison, 101 Murray Street.

Goudreau, Ont.
The contract for the erection of a power house, etc., for the Madoc Mining Company, has been let to the Deakin Construction Company, Limited, 41 Mayor Street, Montreal, on a percentage basis. Approximate cost, $75,000.

Halifax, N.S.
The general contract for the erection of a machine shop for T. Hogan & Company, 123 Water Street, will probably be let to S. M. Brockfield, 58 Granville Street.

Margaree, N.S.
The contract for the construction of a creamery for the Department of Public Works, Halifax, has been let to T. Fraser, Whycocomagh, at $3,000, and the contract for pipe laying to J. C. White, East Margaree.

Montreal, Que.
W. Dufault, 784 Ontario Street E., has let the general contract for the erection of a store and residence to Lacroix & Vezeau, 491 Demontigny Street E. Approximate cost, $3,500.

Work is progressing on the erection of a coal storage building at 1467 Garnier Street for Mrs. L. Glass. The general and carpentry contracts have been let to Nathan Aloff, 1463 Garnier Street. Approximate cost, $7,000.

Ottawa, Ont.
The general contract for the erection of a store and residence for J. Kleegan has been awarded to F. A. Gieck, Cummings Bridge P. O Brick veneer construction, brick foundation, felt and gravel roofing. Approximate cost, $3,500.

The contract for alterations to a store on Sparks Street for the Bank of Ottawa, 116 Wellington Street, has been let to G. Douglas, 382 Waverley Street.

The general contract for alterations to a store for C. A. Douglas, 95 Sparks Street, has been let to Shuttleworth & Black, 21 Euclid Avenue, the contract for copper work to McFarlane & Douglas, Slater Street, and for glazing to W. J. Carson, 293 Laurier Avenue W. Approximate cost, $3,500.

Quebec, Que.
In connection with the store and residence in course of erection for Joseph Cote, 180 St. Paul Street, the contract for plastering has been awarded to V. Parent, 449 St. Francois Street. Painting not let.

Riviere Du Loup, Que.
In connection with the store in course of erection for A. E. Thivierge, the contract for heating and pulmbing has been let to Paquet & Company, and for electrical work to J. A. Thibault. Roofing will be done by the general contractor, J. Charest.

In connection with the store and warehouse in course of erection for T. Langlis, Lafontaine Street, the contract for brickwork has been let to N. Dupont, the woodwork and roofing contract to L. Cote & Lachance & Fils, and the heating contract to Wilfred Beruhe. Estimated cost, $25,000.

St. John, N.B.
The general and carpentry contracts for the erection of a business block for the James Kennedy Estate, 20 King Street, has been awarded to Stanley Williams, Prince William Street, at $8,000, and the masonry contract to R. A. Corbett, Douglas Avenue.

Toronto, Ont.
Work has been started on interior alterations to the store and warehouse of Gourlay, Winter & Leeming, 188 Yonge Street, by the Sutherland Construction Company, 315 Ryrie Building. Estimated cost, $6,500.

Winnipeg, Man.
The following contracts have been awarded in connection with the stores being built for J. Scarf, Kildonan:—brick work, Fletcher & Bold, 178 Rondolph Street; carpentry, Stewart & Green, Perth Avenue; roofing and heating, O-Rib-O Manufacturing Company, Limited, 233 Stradbrooke Ave.; plumbing, W. Wilson, 810 Alverstone Street; electrical work, D. Woodhead, 549 William Avenue.

In connection with the warehouse being built at Chambers and Henry Streets for the Cream of Wheat Company, Minneapolis, Minn., the masonry, carpentry, plastering and painting contracts have been awarded to the general contractor, T. Sharpe, Kennedy and Qu'Appelle Streets, the electrical contract to Marshall Wells Company, Limited, Market Street, and the heating and plumbing contract to Cotter Bros., Ltd., Fort St.

The general contract for the erection of an addition to the King Street Substation has been let by the Board of Control to J. Gunn & Sons, Bank of Nova Scotia Building, at $22,075.

Residences

Bloomsburg, Ont.
Lewis Culver is building a frame residence, estimated to cost $3,000.

Grondines, Que.
Work has been commenced by day labor on the erection of a brick and frame residence for Charles Laganiere. Estimated cost, $8,000.

Halifax, N.S.
Plans of a residence are being drawn for J. M. Davidson, Oxford Street, by W. M. Brown, Merchants Bank Bldg.

Hamilton, Ont.
The erection of a garage and conservatory is contemplated by J. H. Harming, Maple and Blake Streets. Architect, F. W. Warren, Bank of Hamilton Building. Estimated cost, $3,000.

C. G. Hudson, 10 Edinburgh Street, is about to erect a residence, estimated to cost $3,500. Brick construction, stone foundation, shingle roofing.

Montreal, Que.
J. D. Lapointe, 74 Second Avenue, Viauville, is building a residence on Notre Dame Street E., estimated to cost $5,000.

The erection of two residences on Letellier Street has been commenced by E. Picard, 2075 Gouin Boulevard. Approximate cost, $4,000.

F. R. Lanthier, care of the Kingsbury Footwear Company, 679 LaSalle Avenue, contemplates alterations to his residence at 373 Sherbrooke Street E., estimated to cost $5,000.

Joseph Cote, 85 Richmond Street, is building six flats on Mullins Street, at an estimated cost of $4,500. Brick construction, felt and gravel roofing.

Ottawa, Ont.
A. Levinson, 227 Somerset Street E., has prepared plans of a residence to be built on Murray Street at an approximate cost of $6,500. Brick construction, stone foundation, shingle roofing.

W. J. Girvan, 130 Grighton Street, has prepared plans for a residence estimated to cost $4,000. Brick veneer construction, stone foundation, shingle roofing.

The Oakland Land Company are considering the erection of a residence on Bellwood Street at an estimated cost of $5,000. Brick veneer and stucco construction, stone foundation, shingle roofing. Manager, W. J. Spratt, Sunnyside Avenue.

Outremont, Que.
Tenders on plastering, painting, heating, plumbing and electrical work required in the erection of a residence for J. H. Lemieux, 116 Laval Avenue, are being received. Architect, J. Mercier, 22 Craig Street E.

Port Dover, Ont.
A residence, estimated to cost $3,000, is being built by Percy Ryerse, First Avenue. Frame construction, shingle roofing.

Quebec, Que.
The roofing, plumbing and electrical work in connection with the residence being built on Aberdeen Street by E. C. Brochu, 147 St. Cyrille Street, will be done by day labor.

G. Cantin has commenced the erection of a residence on Lee Street, estimated to cost $5,000. Masonry and carpentry will be done by day labor. Contracts will be let for roofing, plastering, painting, heating, plumbing and electrical work.

Thorold, Ont.
Work by day labor has been started on the erection of dwellings for T. J. Foley. Frame construction. Estimated cost, $6,000.

Toronto, Ont.
Davis & Moore, 176 St. Clarens Avenue, have commenced the erection of a pair of residences at 13-15 Brock Crescent. Smaller trades will be sub-let. Brick construction, shingle, felt and gravel roofing. Approximate cost, $5,000.

Plans of a residence to be built at 66 Alexandra Boulevard are being prepared by D. McIntosh, 1119 Yonge St. Estimated cost, $5,000.

The erection of a residence at 46 Alexandra Boulevard has been commenced by J. Percy, 50 Heath Street E. Emaller trades will be let. Approximate cost, $5,000.

H. Cramp, 28 Waylane Avenue, is building a pair of residences on Bingham Street, estimated to cost $4,000. Smaller trades will be let. Brick construction, concrete and brick foundation, shingle roofing.

Work is progressing on the erection of four residences on Beech Avenue, estimated to cost $12,000. Smaller trades will be let by the owner, S. Jackson, 323 Beech Avenue. Brick construction, shingle roofing.

A. Woolrich, 1 Brock Crescent, is razing old buildings on Awde Avenue preparatory to the erection of a pair of residences. Brick construction, shingle, felt and gravel roofing. Estimated cost, $3,800. Smaller trades will be sub-let.

CONTRACTS AWARDED

Beaupont, Que.
In connection with the residence in course of erection for A. Marcil, the masonry contract has been let to A. Latulippe, 118 Bagot Street, and the roofing, heating, plumbing and electric contracts to V. Gauvin, Limoilou. Painting not let.

Belleville, Ont.
The contract for the erection of stores and apartments for the Lister Estate has been let to Perry Denike, 303 Ann St. Approximate cost, $3,000.

Bridgeburg, Ont.
J. C. Purvis has let the carpentry and roofing contracts for the residence in course of erection on Niagara Street to B. Zimmerman.

C. E. Hansel, 204 Ontario Street, St. Catharines, has let the general, carpentry and roofing contracts for the erection of a residence to Oscar C. Teal. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Guelph, Ont.
The following contracts have been let in connection with the three residences in course of erection on Sydenham Street for H. G. Cockburn, Park Avenue:—plastering, J. J. Mahoney, Kent Street; heating, McCormick & Robinson, Market Square; plumbing, Stevenson & Malcolm, Masinoc Building; electrical work, G. E. B. Gringer, Wilson Street.

Halifax, N.S.
In connection with the residences now being erected on Bloomingdale Avenue for R. P. Bell, 3 Prince Street, the contract for plastering and brickwork has been awarded to A. Hutchinson, Dartmouth, N.S., the heating and plumbing contract to Hayman & McKenzie, Water Street, and the electrical contract to J. Starr & Son, Limited, Harbour Street.

Hamilton, Ont.
In connection with the residence in course of erection at Connaught Park for E. W. Vivian, 408 Barton Street E., the heating and plumbing contracts have been let to J. E. Gibson, 676 King Street E. Plastering, painting and electrical work not yet awarded.

London, Ont.
The contract for the erection of a residence for Alexander Campbell, 731 Waterloo Street, has been let to Evans Bros., 905 Queens Avenue. Red pressed brick construction. Approximate cost, $4,000.

The following contracts for the erection of an apartment on William Street for W. Thomas, 531 Dundas Street, have been awarded:—masonry, H. Hayman, 491 Ontario Street; carpentry, R. G. Wilson; plumbing and heating, L. J. Odell, 634 Princess Avenue; plastering, Arthur Dowell, 563 Adelaide Street; slating, J. Whittaker, King Street; electric work, Peoples Electric Company.

The general contract for the erection of a residence at 366 Maitland Street for Mrs. Smibert, Burwell Street, has been let to J. A. Stanley, 1063 Richmond St. Estimated cost, $4,000.

Work has been commenced on the erection of apartments at 512 Williams Street for W. D. Thomas, 531 Dundas Street, by H. Hayman, 491 Ontario St., and R. G. Wilson & Son, 5 St. George Street. Smaller trades will be sub-let. Approximate cost, $6,000.

Maisonneuve, Que.
In connection with the flats being erected by Carriere & Frere Company, Ltd., 31 Laurier Avenue, Montreal, the plastering contract has been let to Charbonneau & Dupre, 1651 Park Avenue, the contract for painting to W .Bourdon, 47 Desjardins Avenue, and for heating and plumbing to J. Vaillancourt, 43 Laurier Avenue W., Montreal.

H. Bernier, 758 Adam Street, has let the contract for heating and plumbing in connection with the residence in course of erection to George Lamothe, 174b Valois Street, Montreal. Report previously published incorrect.

Montreal, Que.
P. Morin, 1158 Bernard Street, has commenced the construction of three flats on the Esplanade, estimated to cost $5,000.

A residence is in course of erection on Notre Dame Street E., for J. D. Lapointe, 74c. Second Avenue. General contractor, Louis Beaudry, Pointe-aux-Tremble. Approximate cost, $5,000.

North Bay, Ont.
The contract for heating and plumbing at the residence in course of erection for W. Aubrey has been awarded to the Cochrane Hardware Limited, 18 Main Street West.

Oshawa, Ont.
A. Black has let the masonry, carpentry and tinsmithing contracts for the erection of a residence to W. J. Holland, Simcoe and Colborne Streets.

Ottawa, Ont.
Bower Bros., 133 Hopewell Street, have let the contract for heating and plumbing in connection with the residence which they are building on Aylmer Street to T. Watters, 288 Booth Street, and the electrical contract to the Dominion Electric Company, 417 Sparks Street. Plastering and painting not yet awarded.

The contract for plumbing and heating in connection with the residence in course of erection for W. F. B. Martin, 145 Third Avenue, has been let to M. M. O'Connell, Limited, 212 Gloucester St.

Work has been started on the erection of apartments on Bethany Street for J. Quinn. The general contract has been let to L. McDonald, 80 Fairmont Street. Brick construction, felt and gravel roofing. Approximate cost, $6,000.

In connection with the tenements being built on York Street by N. Poirier & Son, 193 Cathcart Street, the contract for heating and plumbing has been let to A. Gauthier & Company, Dalhousie Street, and for electrical work to A. C. McDonald, 48 College Street.

Quebec, Que.
Lavoie & Frere, 56 Jeanne d'Arc St., have let the roofing, heating, plumbing and electrical contracts in connection with the residence in course of erection on Aberdeen Street to P. Paradis, 236 d'Aguillon Street. Painting not let.

The contract for masonry in connection with the residence being built on Moncton Street for P. Trudel, 43 d'Aguillon Street, has been awarded to Jincher-eau & Lamonde, Grand Alle, the roofing contract to E. Falardeau, 308 Queen St., and the heating, plumbing and electrical contracts to J. B. Cote, 49 Grant Street.

E. A. Tremblay, 69 St. Nazaire Street, has let the contract for roofing at the residence in course of erection on Bourlamarque Street to O. Barbeau, 154 Franklin Street, and for heating, plumbing and electrical work to J. Brown, 11 Arsenal Street. Painting not let.

In connection with the residence being built on Bourlamarque Street by J. Nadeau, 139 Notre Dame Des Anges Street, the contract for masonry and plastering has been awarded to J. B. Verret & Fils, Limoilou, the roofing contract to O. Barbeau, 154 Franklin Street, and the heating, plumbing and electric contracts to J. Lafrance, 21 Plessis St. Carpentry and painting by owner.

In connection with the residence in course of erection for E. Dube, 163 St. Olivier Street, the masonry contract has been let to V. Parent, 449 St. Francois Street, and the carpentry contract to E. Breton, 75 Latournelle Street. Other trades not let. Approximate cost, $6,000.

Lavoie & Frere, 52 Jean d'Arc Street, are building a residence for N. Maison, 23 d'Artigny Street, estimated to cost $6,000. The roofing, heating, plumbing and electrical contracts have been let to P. Paradis, 236 d'Aguillon Street. Painting contract not yet awarded

Toronto, Ont.
Work has been started on the erection of a rectory on Annette Street for the congregation of St. Cecilia's Roman Catholic Church. The carpentry contract has been let to Madden Bros., 552 Adelaide Street West.

T. A. Manning, 79 St. Clair Avenue E., has let the plastering contract in connection with the residence being built at 101 Walmsley Blvd. to Petrie & Son, 353½ Dupont Street, the contract for painting to A. K. Ottaway, 108 Alcina Ave., and for heating to James & Son, 550 St. Clair Avenue W.

Sparrow & Holden, 167 Ronan Avenue, have let the plastering contract in connection with the erection of a residence to F. Antill, 379 Mount Pleasant Road, the contract for heating and plumbing to G. Moore, 165 Ronan Avenue, and for electrical work to F. A. Turpin, 116 Brunswick Avenue. Brick construction, shingle roofing. Approximate cost, $3,000.

John Tait, 58 Manor Road, is erecting two pairs of residences at 1-7 Park Ave., for C. F. Wagner, 66 Gloucester Street. Smaller trades will be sub-let. Estimated cost, $12,000. Brick construction, shingle, felt and gravel roofing.

Westmount, Que.
The masonry, carpentry and plastering contracts for the erection of a residence for Mrs. L. C. Fee, have been let to T. S. Hudson & Company, Board of Trade Building, Montreal.

Power Plants, Electricity and Telephones

Latuque, Que.
The residence of Oscar Fontaine has been destroyed by fire.

Maisonneuve, Que.
The City Council have decided to purchase a quantity of street lamps and posts. Engineer, M. Dufresne.

Otterville, Ont.
The installation of a hydro-electric system is being considered by the Town Council. Estimates of the cost have been furnished by the Provincial Commission.

Port Rowan, Ont.
The Town Council are obtaining estimates of the cost of installing an electric light plant. Clerk, W. A. Mabee.

Saskatchewan Province
The following Rural Telephone Companies have been authorized to borrow money for the construction of their systems:—Colfax, $8,300, Secretary, A. R. Thomas, Colfax; Gartmore-Zorra, $6,000, H. E. Mapleton, Shillingthorpe; Goodwater, $3,000, D. Dalgleish, Goodwater; Great Deer, $2,500, D. R. Dyck, Borden; Kilmory, $3,800, A. H. Burke, Watrous; Kronau, $8,000, R. R. McElmon, Kronau; New Deloraine, $5,500, A. J. Robertson, Davidson; North Churchbridge, $25,000, A. T. Penwarden; Silverwood, $3,600, Roy Scott, Wapella; South Radisson, $4,000, R. McNaught, Radisson; South Tyvan, $2,700, J. Simpson, Tyvan; Talmage, $5,000, W. T. Crayford, Talmage; Third Meridian, $2,500, E. N. Keeney, Davidson; Thorson, $1,700, M. B. Curry, Macoun; West Graytown, $13,000, B. Brouillet, Graytown.

Winnipeg, Man.
Tenders will be received until July 26th by the Chairman of the Board of Control for two 50-light, high efficiency, incandescent street lighting equipments, complete with lamps. Plans and specifications at office of the Engineer, J. G. Glassco, 54 King Street.

Fires

Brome, Que.
The Dominion Government Creamery has been totally destroyed by fire. Minister of Agriculture, Hon. Martin Burrell.

Leeds Station, Que.
A store, residence, sawmill and cheese factory, belonging to Theophile Beaudoin, have been destroyed by fire. Loss, $12,000.

Mount Forest, Ont.
Fire has caused the following losses: V. E. Lewis, tailor shop, store and residence, $4,500, covered by insurance; H. W. Palmateer, store and express office, $3,000, insurance, $1,500. Mr. Palmateer will possibly rebuild.

Quebec, Que.
A residence belinging to Dion & Freres, 84-86 Victoria Street, has been destroyed by fire. Estimated loss, $5,000.

Fire has destroyed the residence of Mrs. J. Genest, 88 Victoria Street. Loss, $5,000.

Miscellaneous

Chatham, Ont.
The Town Council have passed a by-law for the purchase of motor fire apparatus and truck, at an estimated cost of $13,000. Tenders will be called at once if by-law carries at the polls. Clerk, W. G. Merritt.

Outremont, Que.
The Municipal Council are in the market for machines for penetrating asphalt work. Secretary, E. T. Sampson.

Toronto, Ont.
The Rock & Power Machinery Company, 58 Church Street, are in the market for one ten or fifteen ton locomotive crane, 8 wheel, 38 to 40 ft. boom, equipped with Clam Shell bucket and Ontario boiler.

CONTRACTS AWARDED

Hamilton, Ont.
The City Council have let a contract for the supply of three Chapman rectangular sluice gates to the Turbine Equipment Company, Ltd., C. P. R. Building, Toronto.

Montreal, Que.
J. A. Brosseau, 53 Boyer Street, has awarded a contract for the installation of a baker's oven to Dufort & Mignolet, 240a St. Antoine Street. Fire brick construction. Approximate cost, $5,000.

Transcona, Man.
The Turbine Equipment Company Ltd., C. P. R. Building, Toronto, have been awarded a contract for the supply of two De Laval 8-inch vertical single stage sewage pumps, with a combined capacity of three million gallons per day.

Tenders and For Sale Department

Tenders Wanted

Tenders will be received by the Council of the Township of Hullett up to **Thursday, 29th July,** at **2 p.m.,** for the deepening, widening and straightening of the Drain or Creek known as the "McCall Extension Drain," from a point in the eastern limit of the N ½ of Lot 9, Con. 14 to the outlet at Lot 16, Con. 10, Hullett. An accepted cheque of 5 per cent. will be required to be furnished by the successful tenderer.

The lowest of any tender not necessarily accepted.

JAMES CAMPBELL,
Township Clerk.
29

Tenders for Sewers and Cement Sidewalks

Municipality of Village du Bassin de Chambly

Separate sealed tenders for the construction of sewers and cement sidewalks will be received until **Monday, 7 p.m., July 26th, 1915,** and must be addressed to the Secretary-Treasurer of the Municipality of the Village du Bassin de Chambly, and deposited at his office, said seweis and sidewalks to be constructed in the streets of said Village.

The plans and estimates of these works may be examined at the office of the municipal engineer, M. J. Avila Gravel, 17 Cote Place d'Armes, Montreal.

Any person tendering must deposit an accepted cheque from a chartered Canadian bank, payable to the Municipality of Village du Bassin de Chambly, and amounting to 10 per cent. of the amount of said tender.

The Municipal Council shall be perfectly free to accept or reject any of the tenders. By order,

J. AVILA GRAVEL,
Civil Engineer.
29

Town of Drumheller, Alberta

Waterworks

Sealed tenders, addressed to the undersigned, will be received up till **20 o'clock on Monday, 16th August, 1915,** for the following contracts:—

1. Supply of about one mile of 6-inch and 4-inch steel or cast iron pipe.
2. Supply of Valves and Hydrants.
3. Supply of one H. R. T. Boiler and Stack.
4. Supply of Duplex Pump.
5. Supply of materials for 30,000-gallon wood tank and housing.
6. All labor and certain materials for laying water mains, sinking an open well, constructing pumping station, and erecting wood tank and housing.

Tenders must be accompanied by an accepted cheque for ten per cent. of the amount of the tender.

Plans and specifications and other information may be obtained at the offices of the Consulting Engineers at Winnipeg and Calgary. A deposit of $25.00 will be required on Contract No. 6, which will be returned to bona fide tenders on return of the plans.

The Corporation do not bind themselves to accept the lowest or any tender.

O. McKEE,
Secretary-Treasurer,
Drumheller, Alta.
THE JOHN GALT ENGINEERING CO., LTD.,
Consulting Engineers,
Winnipeg, July, 1915
29

WANTED

For cash, one 8-wheel locomotive crane, about 10 ton, with 38-ft. or 40-ft. boom, and equipped with Clam Shell Bucket. Boiler must pass Ontario specifications.

ROCK & POWER MACHINERY COMPANY,
29 58 Church Street, Toronto.

Tenders for Foundry

Sealed tenders will be received by the undersigned up to **July 29th** for the erection and completion of a Foundry Building at Brighton. All tenders to be marked "Tender for Foundry." Plans and specifications may be seen at the office of the secretary.

Lowest or any tender not necessarily accepted.

GEO. DREWRY,
Secretary of The D. J. Barker Foundry Company, Limited,
29-30 Brighton, Ont.

County of Brant

Sealed tenders, clearly endorsed on the outside, "Tenders for Puttown Bridge" will be received by the Counties of Oxford and Brant up to **12 noon, on Wednesday, 28th July, 1915,** addressed to the County Clerk, County Building, Brantford.

For 150-ft. span, 14 ft. roadway. Pratt Highway Truss Bridge.

For reinforced concrete abutments and wingwalls.

For plain concrete abutments and wingwalls.

Tenders must be on the prescribed form and be accompanied by marked cheque for 5 per cent. of the amount of the larger tender.

The bridge site is 3½ miles west of Paris.

Plans and specifications to be seen at the office of the County Engineer, 4 Temple Building, Brantford.

ALAN M. JACKSON,
County Engineer.
29

Tenders for Supplies

Tenders will be received through registered post only, **up to noon, on Tuesday, August 3rd, 1915,** for the supply of

58. Tie Rods and Tie Plates for Lansdowne Avenue Extension, Toronto Civic Railway.

66. Special Track Work for Lansdowne Avenue Extension, Toronto Civic Railway.

Tenders must be addressed to the Chairman, Board of Control, City Hall, Toronto, and envelopes must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained at the Works Department, City Hall. Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH (Mayor),
Chairman, Board of Control.
29

Sprinkler Wanted

Tenders for a motor-driven combination street sprinkler and flusher will be received by the Sprinkling Committee up to **July 29th, 1915.** For further particulars apply to G. G. Bucher, Chairman Sprinkling Committee, or A. H. Millar, City Clerk, Berlin, Canada. 29

Late News Items

Blue Sea Lake, Que.

Tenders on the erection of a summer hotel are being received by V. Leduc, Wellington and Chandire Streets, Hull. Artificial stone construction, slate roofing. Approximate cost, $8,500. Plans and specifications with Mr. Leduc.

Fort William, Ont.

John King, Victoria Avenue, has commenced the erection of two double residences, estimated to cost $10,000. Work by day labor. Frame and brick construction, stone and concrete foundation, shingle roofing.

Mille Roches, Ont.

Tenders on repairs and construction of a tower at the Chapel of Our Lord of the Sacred Heart are being received by Rev. Corbet McRae, Dickenson's Landing, Ont. Plans and specifications with Mr. McRae.

Montreal, Que.

The following contracts have been let in connection with the theatre in course of erection for the St. Denis Theatre Company, 160 St. James Street:—cut limestone, John Quinlan & Company, 4412 St. Catherine Street, Westmount; hardware, Duraund Hardware Company, 370 St. James Street; modelled plastering, M. R. Guisti, 42nd Street, New York; painting, Shagpat Studios, 6 Beaver Hall Square.

Orangeville, Ont.

Tenders on the construction of a roof at St. Andrew's Church will be received until noon, July 24th, by the Board of Managers.

Ottawa, Ont.

The City Council have let the contract for laying asphalt pavement on Somerset Street to the Ottawa Construction Company, Central Chambers, and for asphalt pavement on Nicholas Street to the Union Construction Company, Bank Street, Chambers.

The general contract for the erection of an addition to a store for R. E. Powell, 290 Elgin Street, has been awarded to Charles Hopewell, 7 Clemow Avenue. Approximate cost, $8,000.

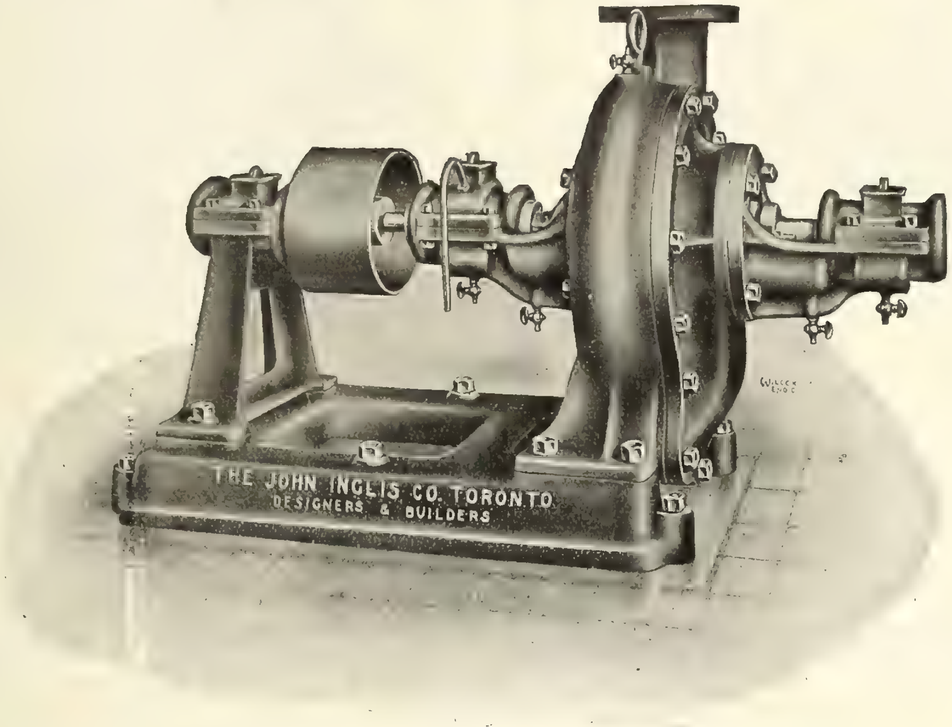
Thetford Mines, Que.

Tenders on the erection of a residence for A. S. Johnson will be received until July 30th by H. G. James, Architect, Whiting Block, Sherbrooke, Que. Cobble stone and roughcast construction, concrete foundation. Approximate cost, $17,000.

Three Rivers, Que.

The Three Rivers Traction Company are building a street railway estimated to cost $150,000. Work by day labor.

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

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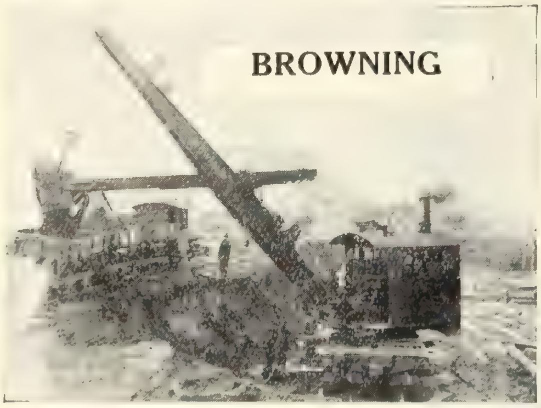
ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Montreal Office: Room 509 Canadian Express Building
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

B B

Note the High-Lift



It goes without saying that the Browning High-Lift is valuable. But note **how** valuable; with a lift of 25 ft. up into cars or wagons the Browning will load 120 yards per hour. Adding pay for engineer, crane man, fireman, laborers, fuel, water, waste and upkeep, the Browning operates for $18.50 per day or a cost per yard of but 5½c., and considerably less if dump trains are continuously available. We have photographs to show how problems like yours have been met. Let us send you these photographs; they are free.

The Browning Company, Cleveland, O.

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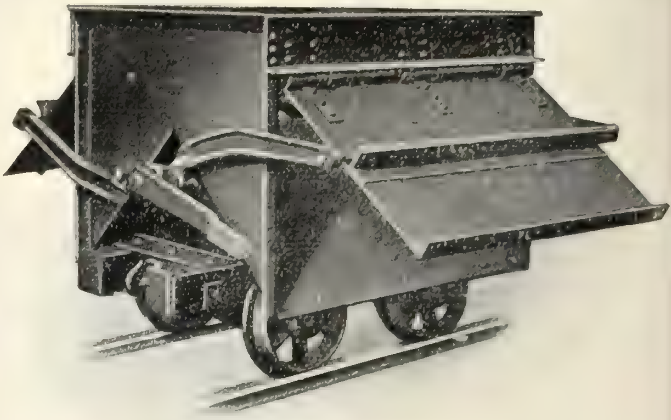
DUMP CARS

Made to dump both sides, both ends, or all round.
All sizes and designs. Steel Construction.

Mine Cars Industrial Cars



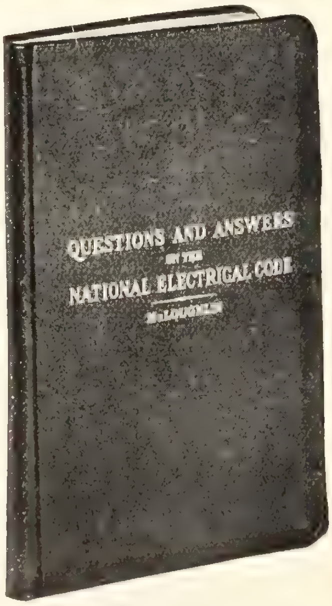
The side dump car, U or V shaped, or constructed as shown above, offers many advantages over other styles for brickyards, contracting work, sand pits, mines, and industrial purposes. Made with chilled semi-steel wheels, cold rolled steel axles, high carbon roller bearings in dust proof boxes.

BRICK MAKING MACHINERY of all kinds. Special attention paid to AUTOMATIC CUTTERS and the equipment of brickyards with ARTIFICIAL DRYERS.

B. E. BECHTEL, Waterloo, Ont.
(Successor to Bechtels Limited)

You Can Interpret the Code Instantly with McLoughlin's

Questions and Answers
on the
National Electrical Code



It tells at once the answer to the questions on code requirements.
Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.
Every question is carefully indexed so that you can locate the fact you are after instantly.
Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.
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Out on the firing line of hot competition every extra shot counts. And to get business now-a-days, that carries a reasonable profit, requires advance knowledge of your prospective customer's wants — it necessitates having the effective business-developing ammunition that MacLean Reports supply.

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Limited
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MODERN
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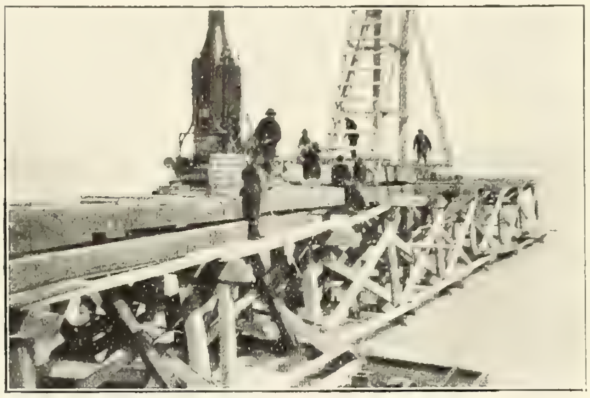

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Standard Machines in stock. Prompt shipments.
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CORRESPONDENCE SOLICITED

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For the Home, Church, or School.

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Hard Wall Plaster

HARD-WALL PLASTER HAMMER TRADE MARK BRAND HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

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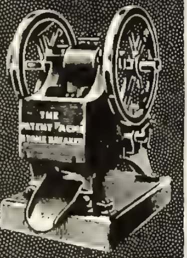
THE MOST EFFICIENT FOR ALL SERVICES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when you install STANDARD Rubber insulated Wires and Cables in that building of yours. Ask our nearest office for prices of STANDARD wire before buying.

Standard Underground Cable Co.
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Manufacturers of Electric Wires and Cables of all kinds for all services, also Cable Accessories.

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Baby FORD Meter Testing Machine

Puts the high-grade Ford equipment within the reach of every waterworks. It tests all makes of meters up to and including 1 inch. The calibrated outlet ranges from 1/32 inch to 1 inch, in ten graduations.

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Exterior view of plant.

This plant has a capacity of 30 tons of garbage daily, is fireproof throughout and can be operated at a low cost. We will be glad to supply plans and data for similar work.

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Special Features

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Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

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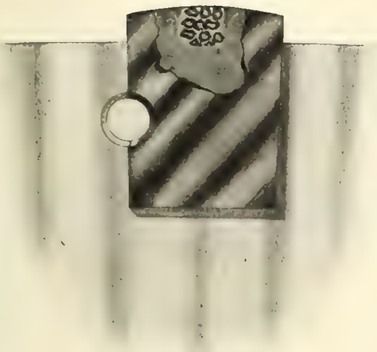

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After costly experimenting, we have produced a Saw Tooth which enables diamond saw owners to reduce their cutting (independent of labour) by 50 per cent.

This Tooth is the "ANDERSON REINFORCED DIAMOND SAW TOOTH."

This Tooth contains, instead of one solid diamond, a number of small pieces making up the same weight. The double advantage being that it COSTS LESS and LASTS LONGER.

With the Reinforced Diamond Tooth the diamond is inserted in a broken condition, and perfectly reinforced with steel. As the tooth wears down only small pieces can go to waste, mere dust, and it is impossible for them to suffer loss through entire or partial breakage so common with teeth cutting the harder building stones.

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To combat the severe corrosive influences of alkali-laden, sulphur-laden and other injurious waters, Toncan Metal Flumes should be used.

TONCAN METAL
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There is no more severe test for any sheet metal than the constant presence of water, as in lumes, and when this water contains injurious elements the danger of corrosion is greatly increased. Yet miles and miles of Toncan Metal Flumes have been in use for years under the most severe corrosive influences and today are still in perfect condition.

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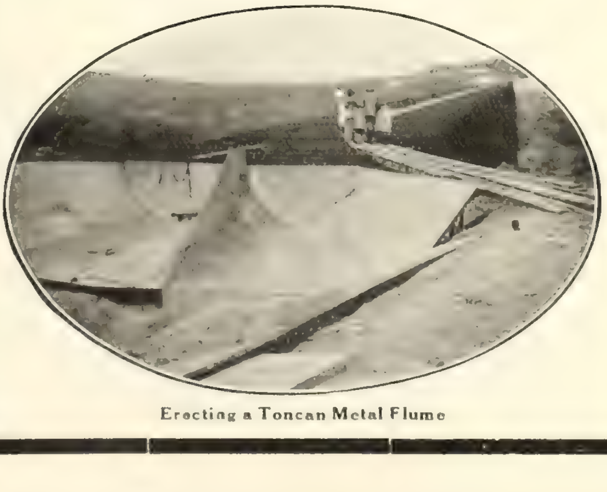

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Taxpayers as well as officials ought to know more about the pavements they use and pay for.

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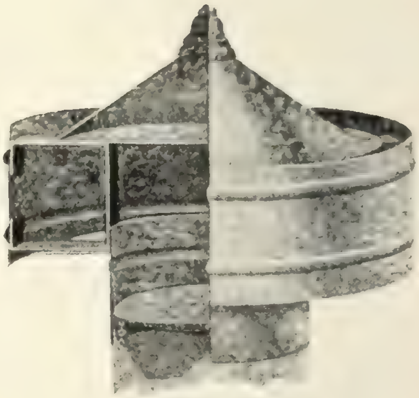

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Estimates furnished promptly, Capacity 18,000 Tons Annually.

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Main Office and Works, Montreal

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That is Clean, Tough Stone of a Quality suitable for Macadam Road and Concrete

We can supply you in any size or quantity.
Our service is unexcelled and our prices right.

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G. W. Essery, Manager

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Their INDIVIDUALITY, DISTINCTIVENESS and BEAUTY make them especially adaptable for exterior use.

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Unit of Plate and Anchorage, Substantial Steel Protection. Rigid, Positive Anchorage. No Splitting of Concrete. Easy to handle and install.

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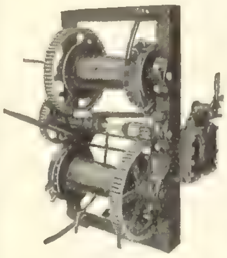

Motor Crab

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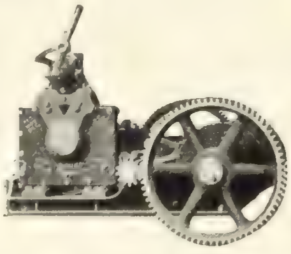
Dake Engine Co.

Grand Haven, Mich.



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Plaster	Sewer Pipe
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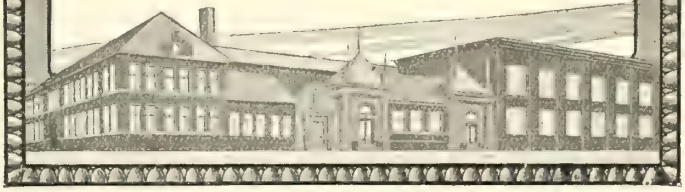

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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.75; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. net cash. Copper bearing sheets—Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.00, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.00. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13½c basis; African hemp, 13½c; sisal rope, 10½c basis; lath yarn, 9¼c. Boiled linseed oil—in barrels, 80c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20. Bags 10 cents extra.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

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Hardwall Plaster, Cement Plaster

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For the best results from gypsum products—specify "Pillar Brand." This brand of hardwall plaster is mixed with the highest grade goat and cattle hair, thoroughly washed and specially prepared. It makes a hard, clean, substantial wall.

"Pillar Brand" plasters are noted for their whiteness, quick setting qualities and hardness.

Shipments by rail or water.

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The Iona Gypsum Co., Limited

Head Office, Sydney, N. S. ***Mills,*** Iona, N. S.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page (66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $11.50 per 100 lbs.; boiled linseed oil, in bbls., 98 cents per gal.; raw linseed oil, in bbls., 95 cents per gal.; dry red lead, $10.00 per 100 lbs.; putty in bulk, $3.25 per bbl.; putty in 25-lb. tins, $3.75; turpentine, in bbls., 80 cents per gal. Mixed paint, ordinary colors, per gal., $3.10.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 350 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35 in car lots, $40 in warehouse; fire clay, $12 per ton in car lots.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galavanized iron—28 gauge, $5.75 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50 to $2.75.

White lead—ground in oil, $10.50 to $11 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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We manufacture a complete line of crushers. Also crushing equipment for quarries, mines, contractors and builders.

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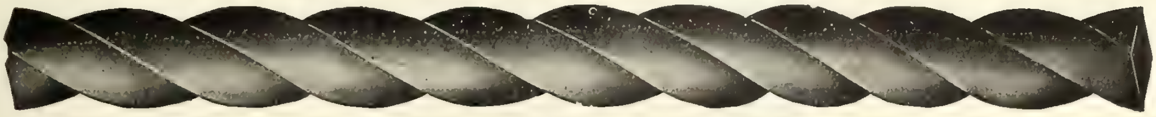

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for Reinforcing Concrete

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Prompt Shipment from Stock

"Come and take a look at the 9 x 12 you furnished us, it is doing fine work."

Mighty nice to be greeted in the above manner, particularly gratifying because the Engine was handling a big clamshell continuously—which as you know is one of the hardest forms of service—and the speaker a man of broad experience.

We can fill your requirements just as satisfactorily.

Hoisting and Material Handling Plant
is our specialty.

Let us have your inquiry for whatever you need in the way of HOISTS, CLAMSHELLS, PUMPS, DERRICKS, DREDGES, Etc.
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3 inches to 60 inches diameter
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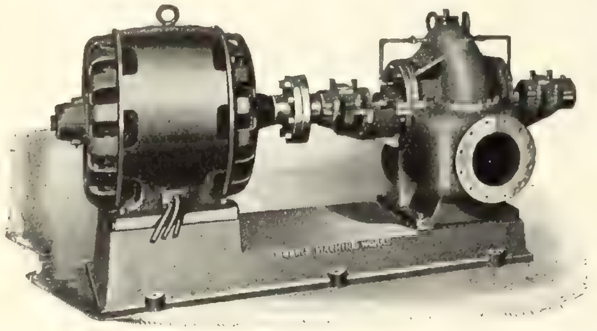

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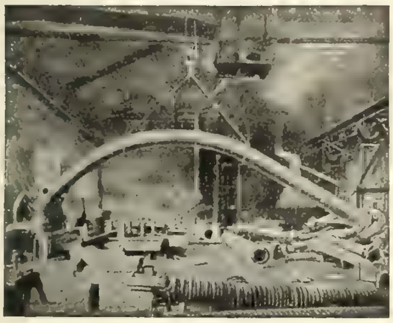

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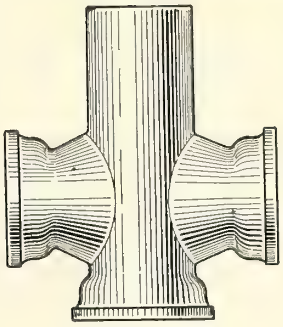

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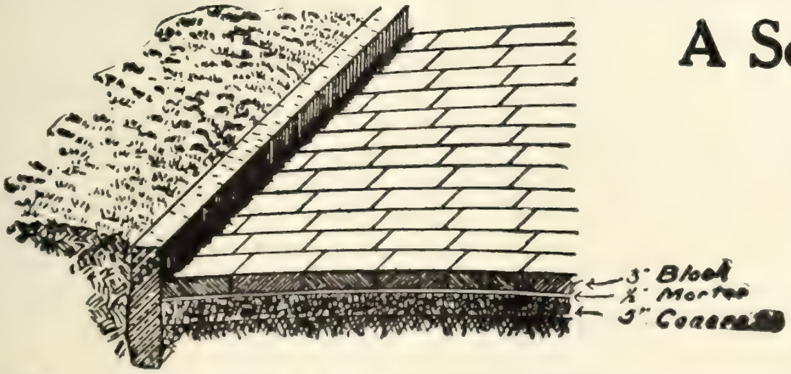

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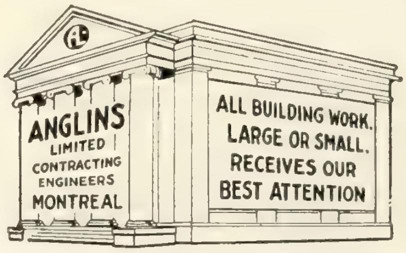
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THE BEST STEEL LOCKERS MADE IN CANADA
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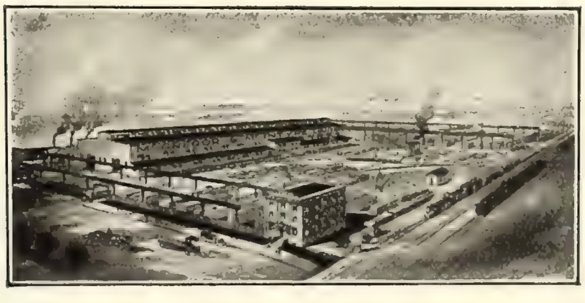

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Capacity: 18,000 Tons Annually

We build and erect all kinds of Structural Steel Work Roof Trusses, Bank and Office Railings, Stair Work, Elevator Grilles, Fire Escapes, etc.

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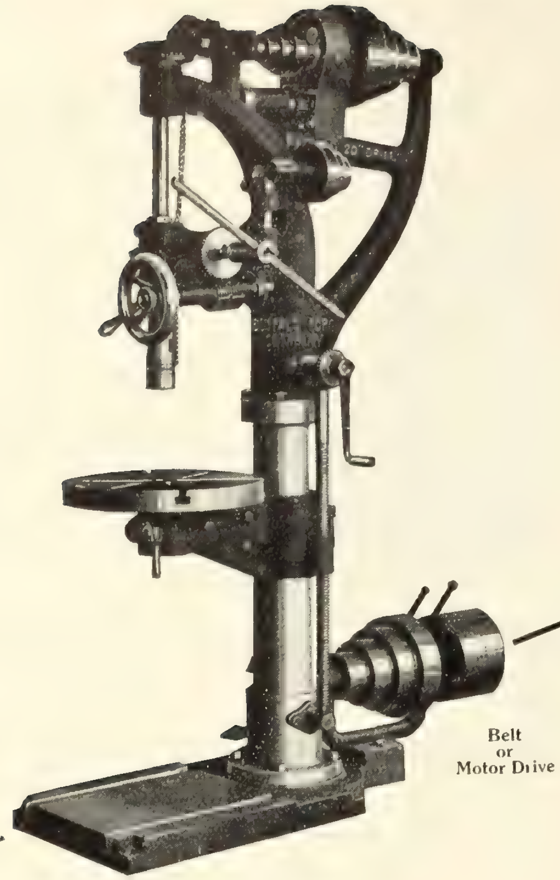

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Drills holes accurately up to 1 1/2 inches.

Has 8 feeds and three power feeds, together with hand and lever feeds.

Furnished for Belt or Motor Drive
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The general make-up of this new Canadian Tool is no exception to the regular high quality of all our other tools.

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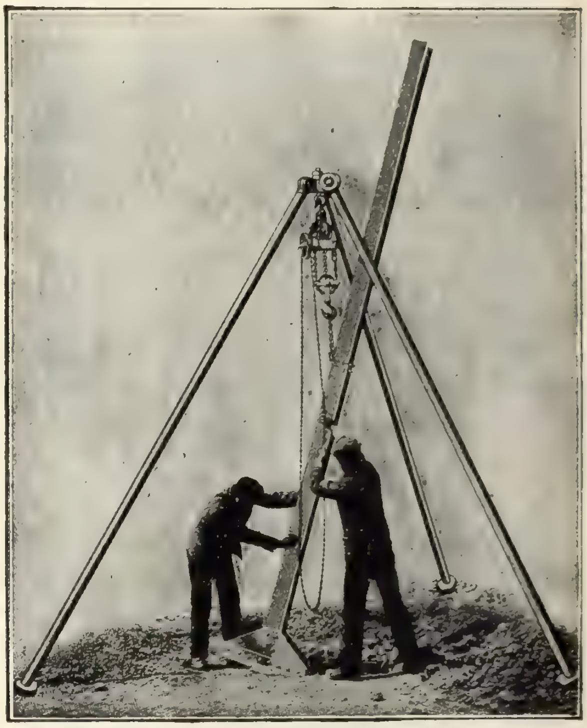

In stock, any load, any height.

This is a strong, light, portable "shear" which has replaced the old-type, heavy timber derrick for laying sewer- and water-pipe, setting stones and monuments, erecting poles and columns, loading cars, hoisting materials on new structures, and for many other purposes.

Each leg is fitted with a pointed foot for hard ground and a broad flange for soft soil.

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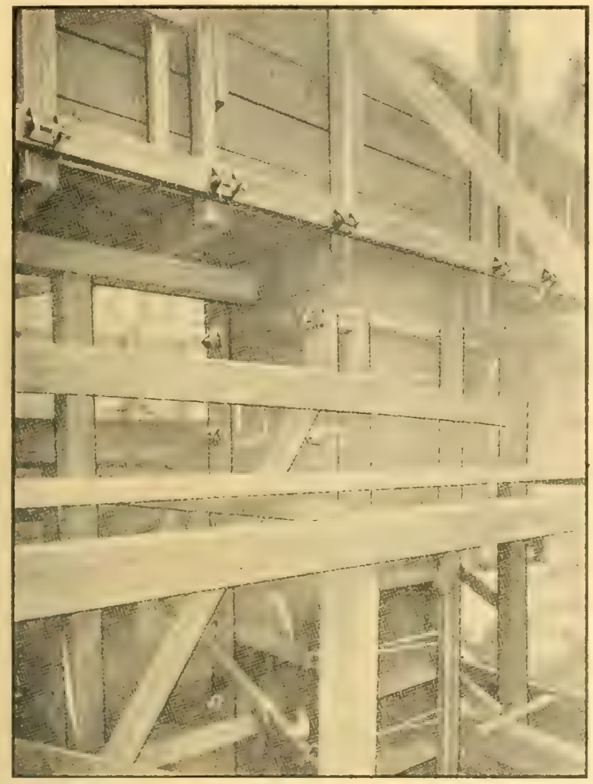

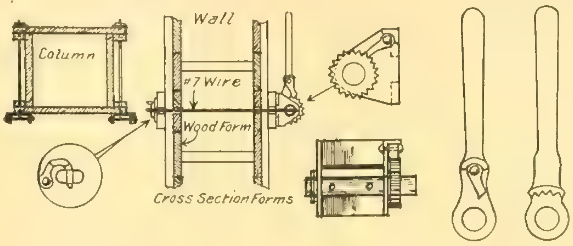

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For walls, columns or pattern work of any size and description Peerless Form Clamps will be found a great labor saving device. Once in place they are there to stay. The small illustration shows the three simple castings that comprise the Peerless. The larger cut shows a wall 29 feet 6 in. high poured in a single day. The forms are tied throughout with Peerless Form Clamps

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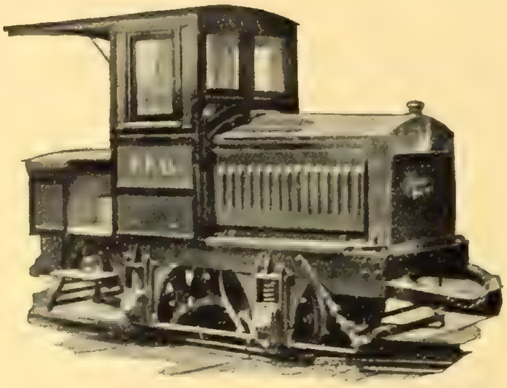

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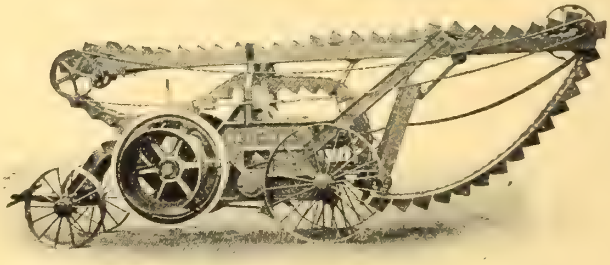

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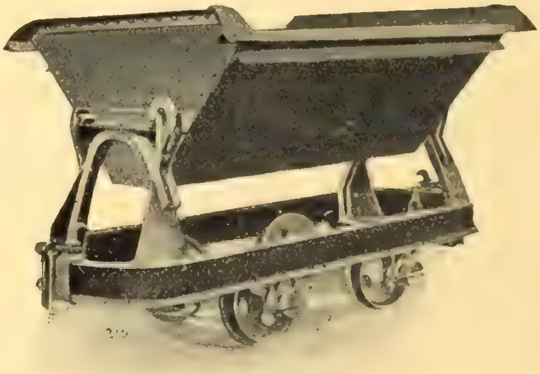

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ESTABLISHED 1886

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Heavy and Light Steel Plate Construction

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Storage Tanks
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WATER TOWERS
For Municipal and
Industrial Water Supply
And Sprinkler Systems

Pressure Tanks
Riveted Steel Pipe
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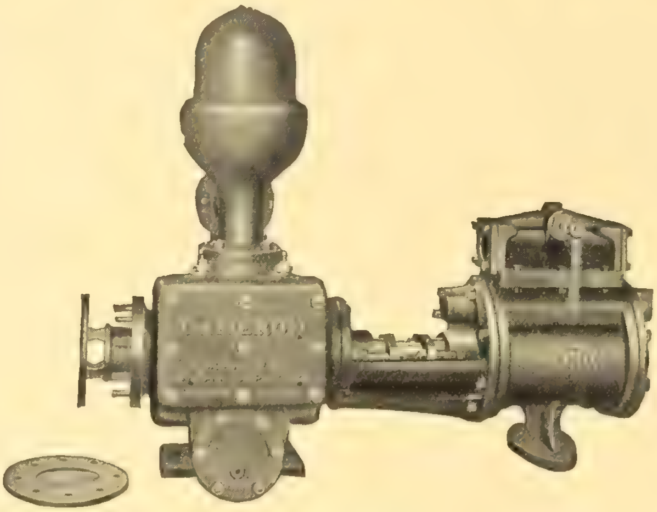
Caissons

The Toronto Iron Works, Limited
Toronto

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements Page 6

CAMERON Pumps



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Removable Bushing Type

The use of a removable cylinder liner secures the greatest possible durability in a pump. This bushing may be turned so that the wear, which is usually greatest on the bottom, can be gradually distributed over every portion of its surface. Then when it is completely worn out a new bushing may be put in without moving the pump or disconnecting the piping.

These pumps last a lifetime.

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MONTREAL, - CANADA

BRANCH OFFICES THROUGHOUT CANADA

28 "Service" Branches
Throughout Canada

**Canadian Consolidated
Rubber Company, Limited**
Montreal, P. Q.

"TAKING ONE'S OWN MEDICINE"

When you find a physician "taking his own medicine," you can usually rely on his diagnosis.

Of the thousand-and-one articles of rubber which we manufacture, practically all are used by us in our own offices, in our own factories, or in our own homes.

WE TAKE OUR OWN MEDICINE

Our line-up is complete, our quality is unexcelled and our prices are right. Let us show you what we can do.

It is our desire to serve you.

**Canadian Consolidated
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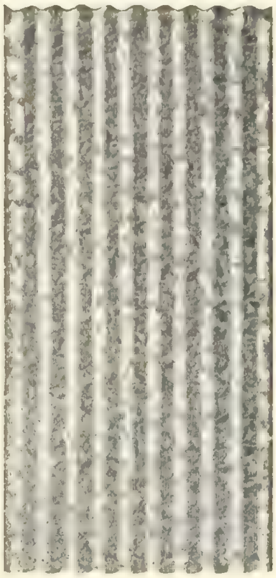
28 "Service" Branches
Throughout Canada

SARNIA CORRUGATED IRON

for Roofing and Siding



We know of no other Corrugated Iron in Canada that the manufacturers can give as strong a guarantee as to its lasting qualities, as we can on our Sarnia Corrugated Iron. All our products are made from the Sarnia New Process Galvanized Sheets, which possess remarkable durability when exposed to the weather, and will resist corrosion and the action of the elements to a much greater degree than ordinary steel or iron or those products based on alleged "purity" of the materials.

Standard sizes carried in stock in 24, 32, 36, 48, 60, 72, 84, 96 or 120" long x 33" wide in 18 x 20, 22, 24, 26 and 28" guage.

We also manufacture Plain Galvanized Iron, Metal Sidings, House Shingles, Ventilators, Sky Lights, Eave Trough, Conductor Pipe, Volleys, etc.

We have specially prepared literature on any of the above products, which we will gladly send you on request.

SARNIA METAL PRODUCTS Co., Limited
SARNIA, ONTARIO

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It's not merely a design or a picture to catch the eye. It is a name that means something to you. It means quality. It means satisfaction. It means service. You will find this name on all genuine Mueller goods. It's on the

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Extension Service Boxes

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The very best value in service boxes ever offered the trade. Their absolute dependability has been proved in thousands of cases.

Here is a box that meets all requirements. Made in Arch or Minneapolis pattern all sizes. We would be pleased to figure on your needs.

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Makers of high grade Water, Plumbing and Gas Brass Goods.

C.R.

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Mueller
Mfg. Co.
Ltd.
SARNIA, ONT.**

Quote me prices on Mueller Extension Service Boxes and send me general catalogue.

Signed ....

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ENGINEERS WANT WIRE-CUT-LUG

Experience and Observation have Convinced Eminent City and County Engineers of the Superiority of Wire-Cut-Lug Paving Brick.

READ THESE TESTIMONIALS:

Mr. R. Keith Compton, Chairman of the Paving Commission, of Baltimore, which city is repaving all its streets and alleys, said on April 5th:

"Wire-Cut-Lug block have given entire satisfaction in this city. We have used the same on the majority of our brick streets since the early part of 1913. At this time we are using Wire-Cut-Lug almost exclusively."

Wm. M. Acheson, Division Engineer, New York State Highway Department, with headquarters at Buffalo, on April 12th said:

"Dunn Wire-Cut-Lug brick used on work in this Division has given satisfactory service—both from a construction and wearing standpoint."

Niagara and Erie Counties, New York, which are in Mr. Acheson's Division, have nearly two hundred miles of brick pavements.

Mr. D. Moomaw, Road Engineer of Cuyahoga County, Ohio, in which County there are three hundred miles of brick pavements, says under date of April 5th:

"Brick roads in Cuyahoga County are now being constructed largely of Wire-Cut-Lug brick. . . . . I am convinced of the superiority of Wire-Cut-Lug brick over repressed. By having the more suitable bonding surface on the sides of the Wire-Cut-Lug brick the cement grout filled pavement produces a wearing surface of much greater slab strength than we have formerly obtained."

Mr. W. A. Stinchcomb, County Engineer, of Cuyahoga County, Ohio, says:

"As to our experience with Dunn Wire-Cut-Lug brick I wish to state that it has been very satisfactory. In fact, we have encouraged contractors on work that was let before the Wire-Cut-Lug brick came on the market, to substitute Wire-Cut-Lug for the repressed. Our experience is that we are able to prepare a much better bond by the use of this brick than with the repressed."

Mr. D. R. Lyman, Chief Engineer, Louisville, Ky., writes:

"We have been laying Wire-Cut-Lug vitrified block in Louisville for about two years and are very well pleased with results obtained. We have always used cement filler with Wire-Cut-Lug blocks and in this class of construction I think Wire-Cut-Lug blocks are superior to repressed blocks on account of the square edges and better density. In general we have secured better results with Wire-Cut-Lug blocks than with repressed blocks and I hope we will be in a position to lay a greater yardage of Wire-Cut-Lug blocks in the future."

Twenty-six independent competing companies, operating forty-two plants and having an aggregate annual productive capacity of 500,000,000 10-pound brick, make Wire-Cut-Lug paving brick.

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United Brick Company, Greensburg, Pa.
  Plant at Conneaut, Ohio.
Sterling Brick Company, Olean, N. Y.
Reynoldsville Brick & Tile Co., Reynoldsville, Pa.
Danville Brick Company, Danville, Ill.
Clinton Paving Brick Company, Clinton, Ind.
Alton Brick Company, Alton, Ill.
Deckman Duty Brick Company, Cleveland, Ohio.
  Plants at Cleveland, Carrollton and Malvern, O.
Tuna Valley Pressed Brick Company, Bradford, Pa.
Foster Paving Block Company, Bradford, Pa.
  Plants at Bradford, Pa., Binghamton, N.Y., and Youngsville, Pa.
Metropolitan Paving Brick Company, Canton, Ohio
  Four plants at Canton, O., one at Willow, O.
Bessemer Limestone Company, Youngstown, Ohio
  Three plants at Bessemer, Pa
Peebles Paving Brick Company, Portsmouth, Ohio.
  Two plants at Portsmouth, Ohio, one at Firebrick, Ky.
Murphysboro Paving Brick Co., Murphysboro, Ill.
Southern Clay Mfg. Company, Chattanooga, Tenn.
  Plants at Robbins, Tenn., Coaldale, Ala.
McAvoy Vitrified 'Brick Company, Philadelphia, Pa.
  Plant at Perkiomen Junction, Pa.
Windsor Brick Company, Akron, Ohio.
Hocking Valley Brick Company, Columbus, Ohio.
  Plant at Logan, Ohio.
Veedersburg Paver Company, Veedersburg, Ind.
Springfield Paving Brick Company, Springfield, Ill.
Terre Haute Vitrified Brick Co., Terre Haute, Ind.
Albion Vitrified Brick Co., Albion, Ill.
Alliance Clay Product Company, Alliance, Ohio.
Westport Paving Brick Company, Baltimore, Md.
Mack Manufacturing Company, New Cumberland, W.Va.
  Four plants at New Cumberland, W. Va.
The Hydraulic Press Brick Company, St. Louis, Mo.

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THE DUNN WIRE-CUT-LUG BRICK CO. (Licensors) Conneaut, Ohio

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Ceresit Waterproofing Co.

Centrifugal Blowers & Compressors
De Laval Steam Turbine Co.
E. Laurie Company
Turbine Equipment Company

Ceresitol
Ceresit Waterproofing Co.

Chains
Woodhouse Chain Co.

Chain Blocks
Morris Crane & Hoist Co., Herbert

Chimneys (Reinforced Concrete)
Laurie Company, E.
Turbine Equipment Company

Coal Chutes
Manitoba Bridge & Iron Works

Coal Handling Apparatus
Beatty & Sons, M.
Browning Company

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London Concrete Machinery Co.

Concrete Mixers and Appliances
Canadian Fairbanks-Morse Co.
Goold, Shapley & Muir Co.
Hopkins & Co., F. H.
London Concrete Machinery Co.
Woodstock Concrete Mach. Co.

Concrete Form Clamps
Railway Contractors Supply Co.

Conduits
Can. H. W. Johns-Manville Co.
Conduits Co., Ltd.
Orpen Conduit Co., Ltd.
Ric-wiL Underground Pipe Covering Company

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Wells & Gray

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Browning Company
Can. Fairbanks-Morse Company
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Dake Engine Company
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Marsh & Henthorn
Morris Machine Works
Montreal Locomotive Works
Rock & Power Machinery Co.
Stinson-Reeb Builders' Supply Co.

Conveying Machinery
Dull Company, Raymond W.
Goodwin, Barsby & Co.
Sturtevant Co. of Can., Ltd., B. F.

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Can. Ingersoll-Rand Co., Ltd.

Corrugated Iron
Can. H. W. Johns-Manville Co.
Metallic Roofing Co.
Pedlar People Limited
Sarnia Metal Products Company

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Can. Consolidated Rubber Co.

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Browning Company
Hopkins & Co., F. H.
Morris Crane & Hoist Co., Herbert
Northern Crane Works
Pollard Mfg. Company

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Canada Crushed Stone Corporation
Canadian Equipment Company
Crushed Stone, Limited
Hagersville Contracting Co.

Crushers (Stone and Rock)
Dominion Road Machinery Co.
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
London Concrete Machinery Co.
Rock & Power Machinery Co.

Culverts
Pedlar People

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Ceresit Waterproofing Co.

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Aikenhead Hardware Limited
Beatty & Sons, M.
Hopkins & Co., F. H.
Marsh & Henthorn, Limited
Northern Crane Works
Pollard Mfg. Company

Door Hangers
Allith Mfg. Company

Dredging Sleeves
Can. Consolidated Rubber Co.

Dredges
Beatty & Sons, M.
Browning Company
Canadian Equipment Company
Hopkins & Co., F. H.

Drills
Canadian Blower and Forge Co.
Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Lecky & Collis.

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

Dump Carts and Wagons
Canadian Equipment Company
Deere Plow Co., John
Tiffin Wagon Co.
Watson Wagon Co.

Dump Cars, Wheels, etc.
Bechtel, B. E.
Canadian Equipment Company
Hopkins & Co., F. H.
Manitoba Bridge & Iron Works
Marsh & Henthorn
National Steel Car Company
Sheldons Limited

Drying Apparatus
Sturtevant Co. of Can., Ltd., B. F

Electricians' Gloves
Can. Consolidated Rubber Co.

Electricians' Plugs
Can. Consolidated Rubber Co.

Electric Fans
Sturtevant Co. of Can., Ltd., B. F.

Electric Air Rock Drills
Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
Gent & Company

Electric Steel Castings
Electric Steel & Metals Co.

Elevator Doors
Ormsby Company, A. B.

Elevators
Chelsea Elevator Company
Northern Crane Works
Roelofson Elevator Works
Turnbull Elevator Co.

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American Enamelled Brick & Tile Company

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Dull Company, Raymond W.
Hopkins & Co., F. H.
Pawling & Harnischfeger

Exhaust Heads
Canadian Blower and Forge Co.
Sheldons Limited

Engines
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Can. Fairbanks-Morse Company
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Inglis Company, John
Laurie & Lamb
McDougall Caledonian Iron Wks.
Rock & Power Machinery Co.

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Bowman & Connor
Cape Company, E. G. M.
Chipman & Power
Dominion Engineering & Inspection Company
Farmer, John T.
Galt Engineering Co., John
R. S. & W. S. Lea.
McDougall, Geo. K.

Expanded Metal
Pedlar People Limited
Trussed Concrete Steel Co.

Fans
Sheldons Limited
Sturtevant Co. of Can., Ltd., B. F.

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Can. Consolidated Rubber Co.

Filtration Plants
verMehr Engineering Co., John

Fireproof Doors and Windows
Hope & Sons, Henry
Ormsby Company, A. B.
Pedlar People Limited
Steel & Radiation Limited
Trussed Concrete Steel Co.

(Continued on page 12)

Bank of Toronto Building, King and Bay Streets, Toronto
All Tennessee Marble "backed" with No. 110 "R. I. W."

MANUFACTURED IN CANADA BY

"R. I. W." Damp Resisting Paint Co.

202 Mail Bldg., TORONTO (Toch Bros.—Est. 1848) Factory: OAKVILLE, Ont.

DISTRIBUTORS:

Black Building Supply Company, Limited, Toronto
Western Paint Company, Winnipeg
Dartnell, Limited, Montreal
Canadian Equipment & Supply Co., Ltd., Calgary and Edmonton

Write to nearest distributor for full information.

CUT STONE

should be "backed" with

No. 110 "R. I. W." Damp-Resisting Paint

to prevent discoloration by cement mortar

May we send you a copy of the "Red Book," explaining why?

No. 110 "R.I.W." is also used in factories, laboratories, etc., for the protection of metal or wood that is subjected to the fumes of acids or alkalies, and on structural steel imbedded in masonry.

DUNDAS QUARRY
Capacity 4000 Tons Daily

OUR

Facilities for supplying any quantity of

CLEAN CRUSHED STONE

Are Unexcelled

SHIPMENTS — G. T. R. & C. P. R.

Team Delivery If Required

CEMENT

SAND

GRANOLITHIC
TRAP-ROCK

Rogers Supply Co., Limited

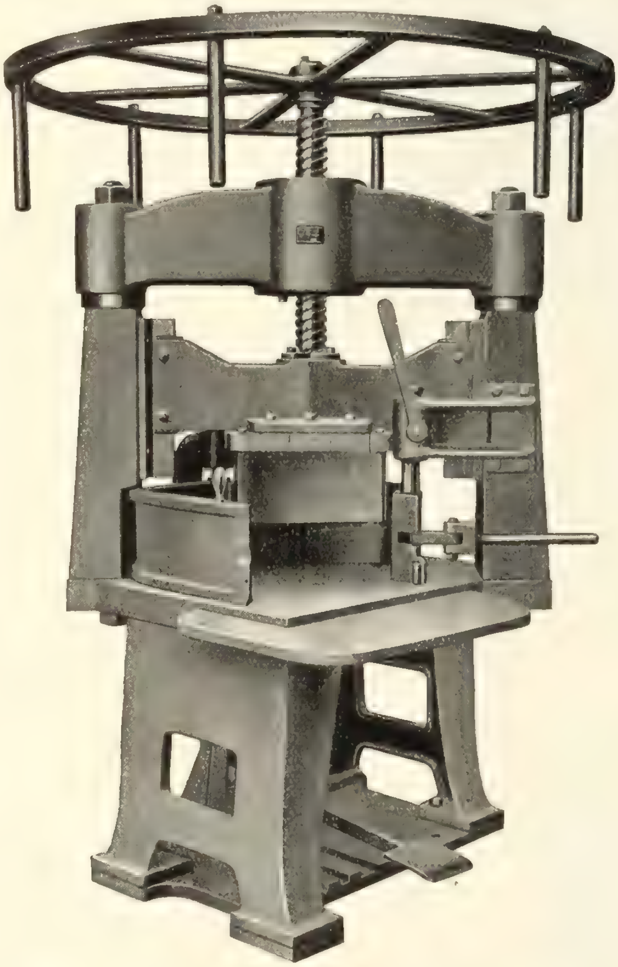
28 King St. W., Toronto

MAIN 4155

We manufacture the most comprehensive range of

CLAY-WORKING MACHINERY

in the world



The Crossley Improved Sagger Press

The Crossley Improved Sagger Press, capable of making from 600 to 800 saggers per ten hours, according to height, at a manufacturing cost of less than one cent each. In the operation of this press, one man is required to superintend the hand wheel, one to operate the die and a boy to cut off the clay as it comes from the pug mill, and remove the finished saggers to the drying room.

This is but one of our modern machines for progressive clay-workers. Write for 180-page catalogue.

The
Crossley Machine Co.
Trenton, New Jersey, U.S.A.

KERR

Gate Valves

and

Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

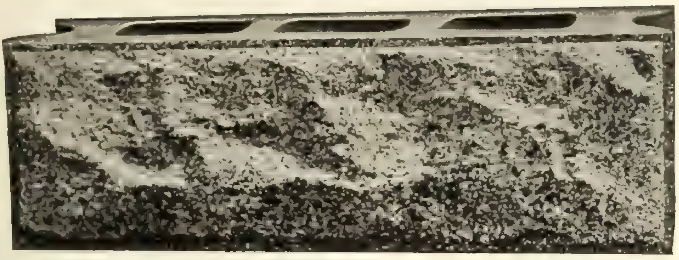
Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO

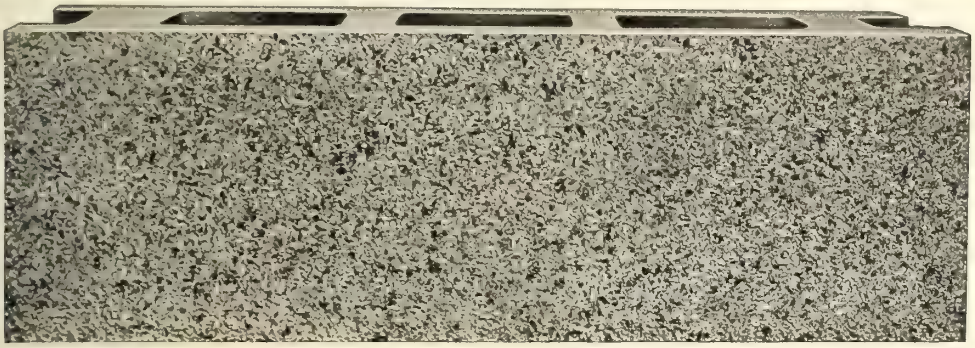


Molds for Casting
Waterproof Hollow Cement Building Blocks
With Granite Faces

THEY COST LESS — THEY SELL FOR MORE
YOU SELL MORE OF THEM

8 x 8 x 24 inch Granite Rock Face Block

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

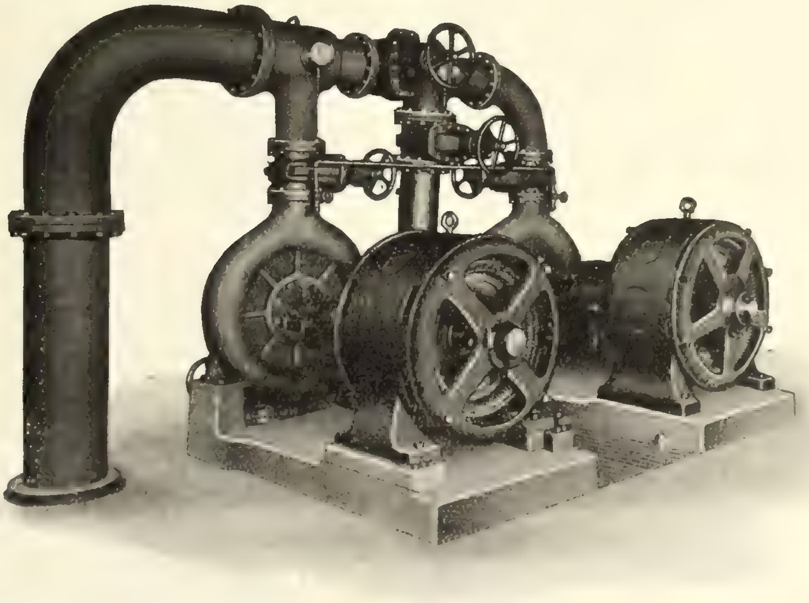
Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited (Zagelmeyer System)
298 Howard Avenue, WINDSOR, ONTARIO

Turbine Pumps
Electric and Steam
Water Works
Factory and
Fire Services
Humphrey Gas
Pumps
Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL
CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

THE "PANAMA BOSTON" GRADER

(For 2 or 4 horses—Weight 1000 lbs.)

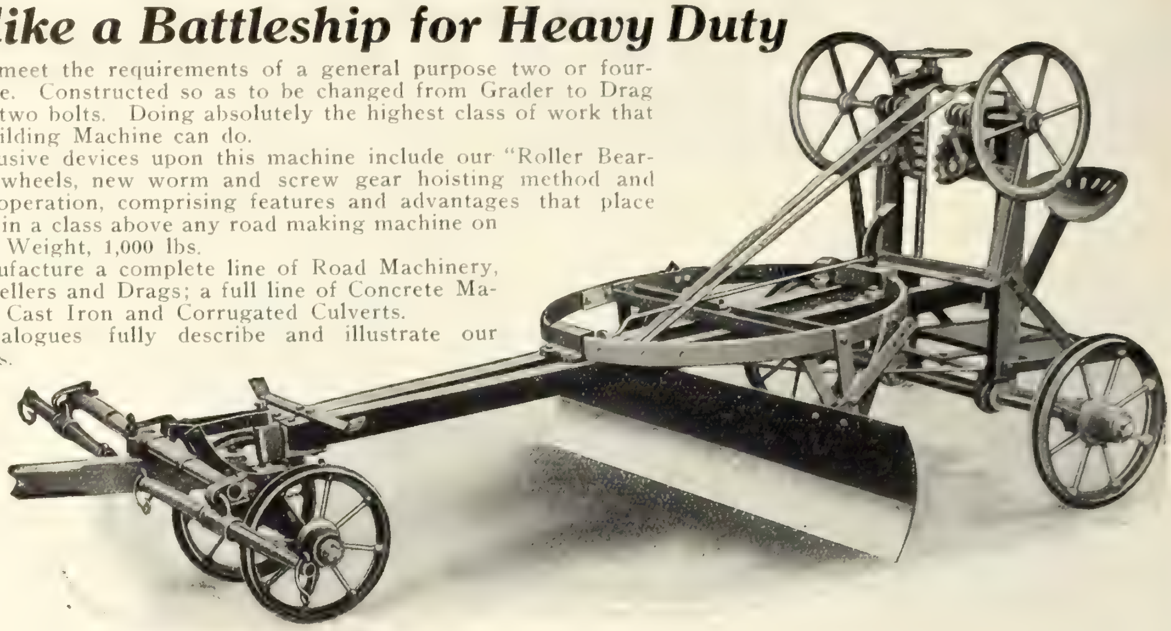
Built like a Battleship for Heavy Duty

Built to meet the requirements of a general purpose two or four-horse machine. Constructed so as to be changed from Grader to Drag by removing two bolts. Doing absolutely the highest class of work that any Road Building Machine can do.

The exclusive devices upon this machine include our "Roller Bearings" on all wheels, new worm and screw gear hoisting method and economy of operation, comprising features and advantages that place this machine in a class above any road making machine on the market. Weight, 1,000 lbs.

We manufacture a complete line of Road Machinery, Graders, Levellers and Drags; a full line of Concrete Machinery; and Cast Iron and Corrugated Culverts.

Our catalogues fully describe and illustrate our different lines.



THE LARGEST LINE OF ROAD MACHINERY—"MADE IN CANADA"

Ask for 1915 Catalogue No. 25

The Exeter Mfg. Co., Limited, Exeter, Ont.

Ask for 1915 Catalogue No. 25

J. L. Neilson, Winnipeg, Man., Western Agents H. S. Hancock, Ft. William, Agent N. Ont. Lacie Chas A. Paquet Ltree, Quebec, Que.

Steel Derricks

50 Tons Capacity

We specialize in the manufacture of steel guy derricks and are prepared to ship this class of derrick in capacities from 5 to 50 tons.

The illustration shows the largest steel guy derrick in Canada. It is our make and "Made in Canada".

Electric Hoists—Cranes—Derrick Irons

Stone and Marble Working Machinery

POLLARD MFG. CO.

LIMITED

Niagara Falls, Canada

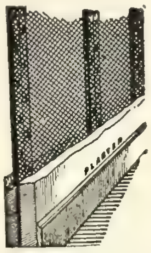
PEDLAR'S "PERFECT" PRODUCTS
MADE IN CANADA

When YOU Figure on a Job

for a modern fire-proof building, one of the first things to take into consideration is the lath.

Contractors and engineers everywhere are specifying Pedlar's "Perfect" Expanded Metal Lath, because it insures longer life of buildings and perfect fire protection, giving more warmth in winter and cooler buildings in summer.

PEDLAR'S "PERFECT" EXPANDED METAL LATH



provides the best means known for bonding cement and plaster to flat surfaces.

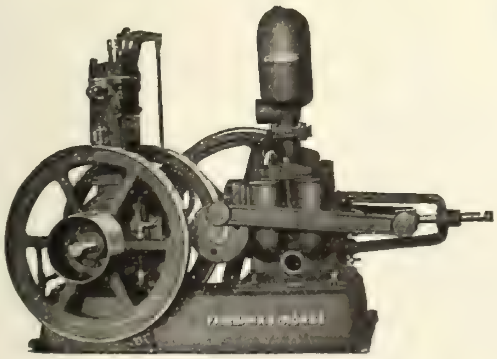
Made in our own shops from the very highest grade, special unpickled sheet metal and supplied either painted or galvanized. Furnished in large sheets 96" x 24"—convenient to use and easily applied. Cost is moderate as compared with wood lath.

The slight extra cost is more than compensated for by the saving of time and labor in applying.

Write nearest branch for Lath Booklet "C.R." and free samples.

THE PEDLAR PEOPLE, LIMITED
(Established 1861)
56-Q
Executive Office and Factories: OSHAWA, ONT. Branches: Montreal Ottawa Toronto London Winnipeg

Fairbanks-Morse
Pumping Outfits



This outfit consists of a 2 H.P. gasoline engine geared to 5x5 F-M Typhoon Pump. It has a capacity of 39 U.S. gallons per minute against a head of 40 lbs. pressure.

"Units of Undivided Responsibility" they are made up from standard equipment to suit your individual requirements. They will give you the most economical service.

The illustration shows a small gasoline engine direct connected to a small pump, both mounted on an iron base. We can make up any outfits direct connected or belted, any style of pump and any method of drive.

Let us quote on your requirements.

The Canadian Fairbanks-Morse Co., Limited
St. John Quebec Montreal Ottawa Toronto Hamilton Winnipeg
Saskatoon Calgary Edmonton Vancouver Victoria

Canada's Departmental House for Mechanical Goods

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- Fire Escapes
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  - Ceresit Waterproofing Co.
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  - Peerless Form Clamp Co.
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- Gasoline Engines
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  - Northern Crane Works
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  - Pawling & Harnischfeger
- Hoisting Engines
  - Beatty & Sons, M.
  - Hopkins & Co., F. H.
  - Marsh & Henthorn, Limited
- Hydrants
  - Canada Iron Corporation
  - Gartshore-Thompson Pipe Co.
  - Kerr Engine Company
- Incinerators
  - Ideal Incinerator & Contracting Company, Limited
  - Toronto Furnace & Crematory Co.
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  - Standard Underground Cable Co. of Canada, Limited
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  - Bechtel, B. E.
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- Jib Cranes (all kinds)
  - Morris Crane & Hoist Co., Herbert
  - Northern Crane Works
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  - Canadian Blower and Forge Co.
  - Sheldons Limited
  - Sturtevant Co. of Can. Ltd., B. F.
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  - Berlin Mills Company
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  - Bishopric Wall Board Co.
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  - Dominion Lime Company
  - Standard White Lime Co.
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  - Can. H. W. Johns-Manville Co., Limited
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  - Montreal Locomotive Works
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  - Pollard Mfg. Company
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  - Metallic Roofing Company
  - Noble, C. W.
  - Pedlar People Limited
  - Steel & Radiation Ltd.
  - Trussed Concrete Steel Co.
- Metallic Roofing
  - Pedlar People Limited
- Mechanical Draft Apparatus
  - Sturtevant Co. of Can. Ltd., B. F.
- Meter Boxes
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- Meters, Water
  - McDougall Caledonian Iron Wks.
  - Neptune Meter Co.
- Moulds for Cement Blocks
  - Cast Stone Block & Machine Co.
- Oil Pumps
  - Wayne Oil Tank & Pump Co.
- Oil Tanks
  - Wayne Oil, Tank & Pump Co.
- Ornamental Moulds
  - London Concrete Machinery Co.
- Overhead Runways
  - Morris Crane & Hoist Co., Herbert
- Packing
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- Paints and Varnishes
  - Dominion Paint Works
  - Hopkins & Co., F. H.
- Paving and Paving Materials
  - Asphalt & Supply Company
  - Barber Asphalt Paving Co.
  - Dunn Wire-Cut-Lug Brick Co.
  - National Paving Brick Manufacturers' Association
  - Ontario Asphalt Block Co.
  - Paterson Mfg. Co., B.
- Pipe (Concrete, Iron and Wood)
  - Dominion Concrete Co.
  - Gartshore-Thomson Pipe Co.
  - National Iron Works
  - Pacific Coast Pipe Co.
  - United States Cast Iron Pipe Co.
  - Vancouver Wood Pipe & Tank Company
  - Warren Foundry & Machine Co.

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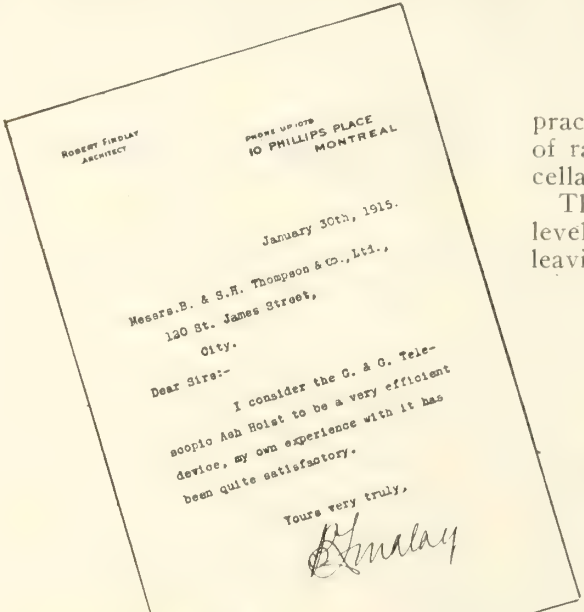


ROBERT FINDLAY
ARCHITECT

PHONE UP.1078
10 PHILLIPS PLACE
MONTREAL

January 30th, 1915.

Messrs.B. & S.H. Thompson & Co., Ltd.,
120 St. James Street,
City.

Dear Sirs:-

I consider the G. & G. Telescopic Ash Hoist to be a very efficient device, my own experience with it has been quite satisfactory.

Yours very truly,

RFindlay

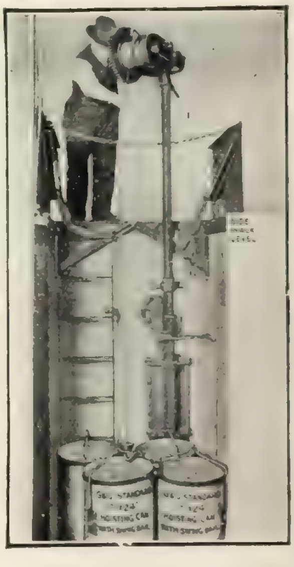
Robert Findlay, Arch.

A "One-Man" Ash Hoist

The G & G Telescopic Hoist is so designed that it is practical for one man unaided to perform the entire operation of raising ash cans to sidewalk and lowering empty cans to cellar.

The operator standing at sidewalk level can raise 4 or 5 cans without leaving the sidewalk.

The G&G
PATENTED
Telescopic Hoist
with compound gear and brake attachment



Raises a maximum load of 500 lbs. at a guaranteed speed of 30 feet per minute.

When not in use, hoist telescopes and no part shows above street level. This hoist is fitted with a patented "silencer," making it absolutely noiseless in operation. It can be installed in any building, old or new.

"Made in Canada"

Write to our nearest agent for booklet and prices.

GILLIS & GEOGHEGAN, Sherbrooke Que.

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Agent for Ontario
Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

W. T. Grose, Agent for Manitoba, Saskatchewan, Alberta, Winnipeg

"Made in Canada"

TRADE **CHAMPION** MARK
STREET SPRINKLERS

All steel tanks, mounted upon steel underframing, platform, spring gears. Springs tested for the different capacity tanks under which they are placed. Choice of valves. Wheels made of the best XXX oak rims, spokes of split oak billets, and hubs of selected elm, with 5/8 in. thick tires. Three and four inch wide tires as desired.

Send for Bulletin.

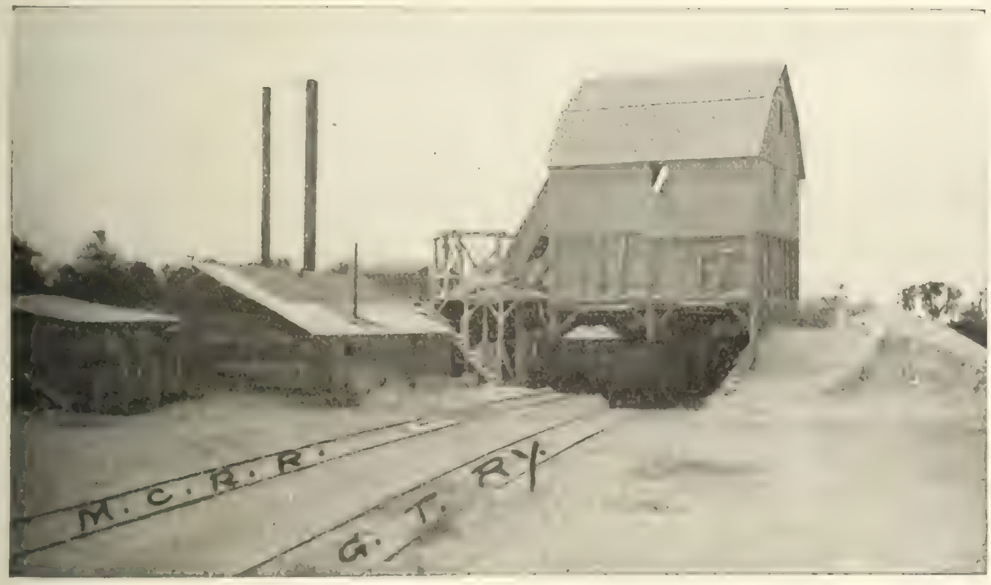
Capacity
350 Imperial Gallons
500 Imperial Gallons
600 Imperial Gallons
750 Imperial Gallons

Write for Catalog

A Full and Complete Line of Road, Street and Contractors' Machinery.

Manufactured by
THE DOMINION ROAD MACHINERY CO., LIMITED, Goderich, Ont.

Macadam Roads



must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Inglis Company, John
- Laurie Company, E.
- McDougall Caledonian Iron Wks.
- Morris Machine Works
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- Turbine Equipment Company

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- Lecky & Collis
- George Anderson & Co.
- Goodwin, Barsby & Company

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- Hopkins & Co., F. H.

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- Goodwin, Barsby & Company

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- Asphalt & Supply Company

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- Burlington Steel Company
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- Dominion Iron & Steel Co.
- Pedlar People Limited
- Steel & Radiation Ltd.
- Trussed Concrete Steel Co.

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- Exeter Mfg. Co., Ltd.
- Hopkins & Co., F. H.
- Morrison & Co., T. A.

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- Hope & Sons, Henry

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- Bird & Son
- Bishopric Wall Board Co.
- Can. H. W. Johns-Manville Co., Ltd.
- Noble, Clarence W.
- Paterson Mfg. Co.
- Pedlar People Limited

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- Can. Consolidated Rubber Co.

Rubber Cement
- Can. Consolidated Rubber Co.

Rubber Mats
- Can. Consolidated Rubber Co.

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- Rogers Supply Company

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- Dull Company, Raymond W.

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- Can. Fairbanks-Morse Company
- Taylor, J. & J.

Scales
- Can. Fairbanks-Morse Company

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- Canada Wire & Iron Goods Co.
- Dominion Road Machinery Co.
- Dull Company, Raymond W.
- Goodwin, Barsby & Company

Sewer Pipe
- Britnell & Company
- Canada Iron Corporation
- Dominion Sewer Pipe Co.
- Gartshore Thomson Pipe Co.
- London Concrete Machinery Co.
- National Iron Works
- Ontario Sewer Pipe Co.
- Smyth & Ryan
- Standard Clay Products Ltd.

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- Bishopric Wall Board Co.

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- Browning Company
- Beatty & Sons, M.
- Canadian Equipment Company
- Hopkins & Co., F. H.
- Montreal Locomotive Works

Silo Moulds
- London Concrete Machinery Co.

Skylights
- Hope & Sons, Henry
- Pedlar People Limited

Smoke Stacks
- Chicago Bridge & Iron Works
- DesMoines Bridge & Iron Co.
- Hamilton Mfg. Co., Wm.
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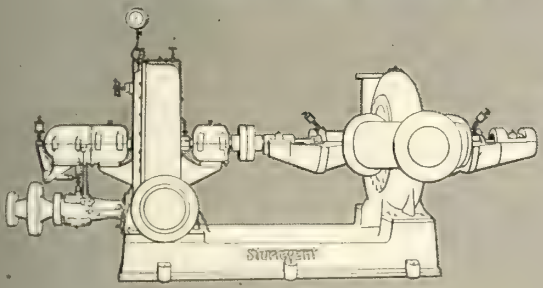

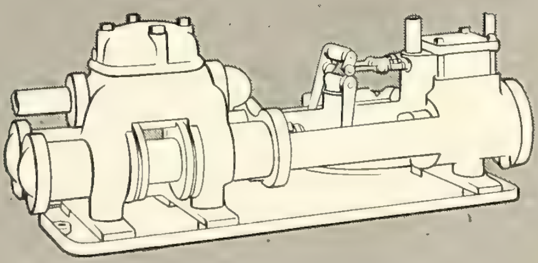

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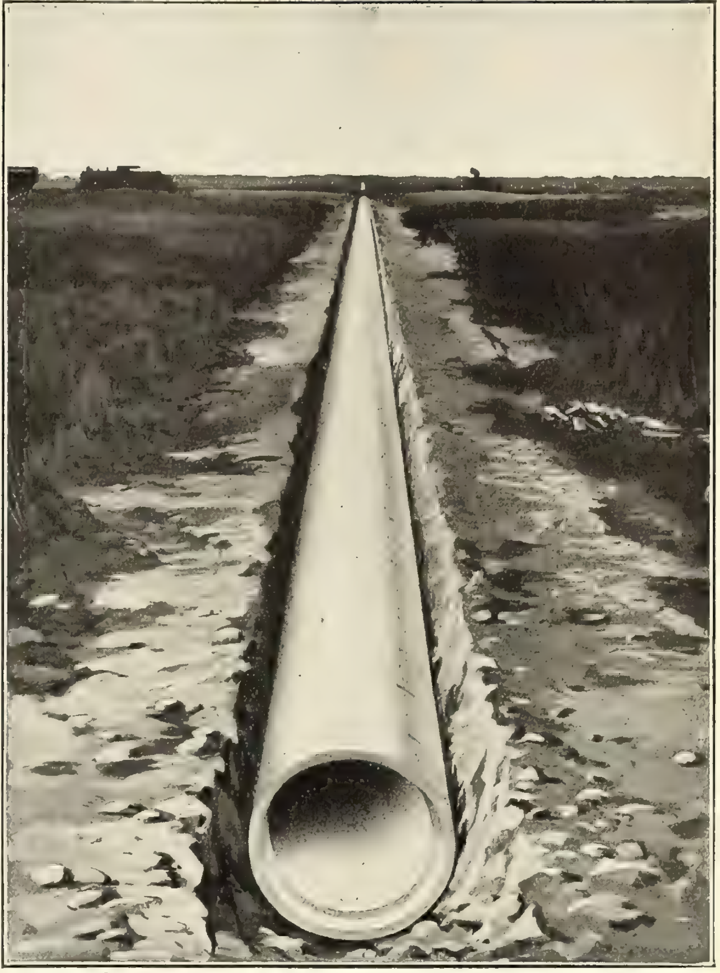

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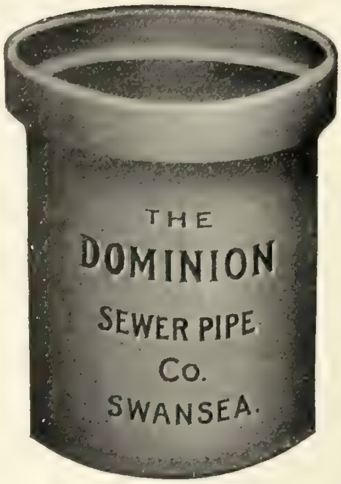

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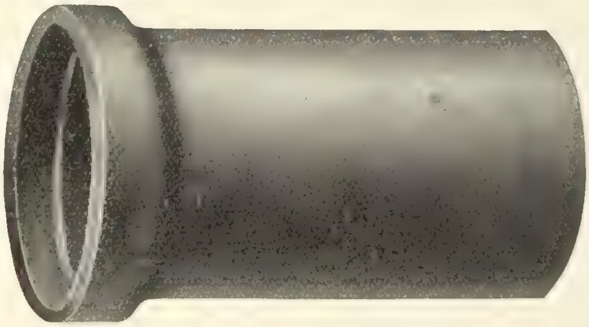

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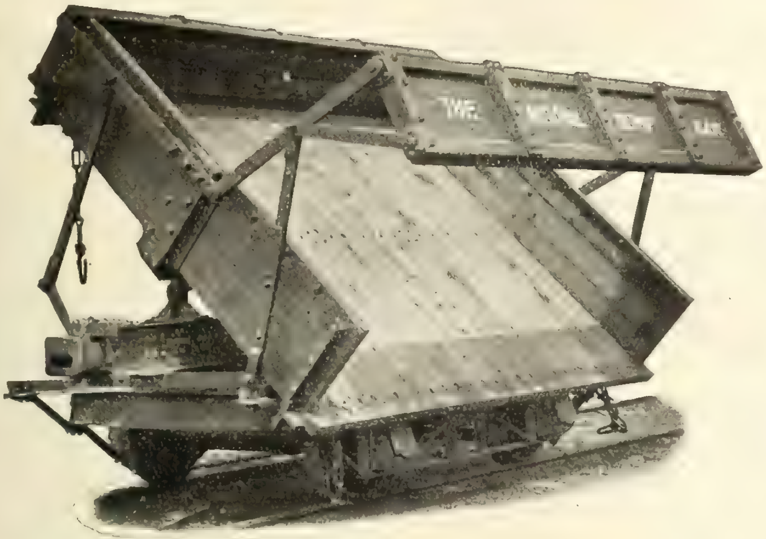

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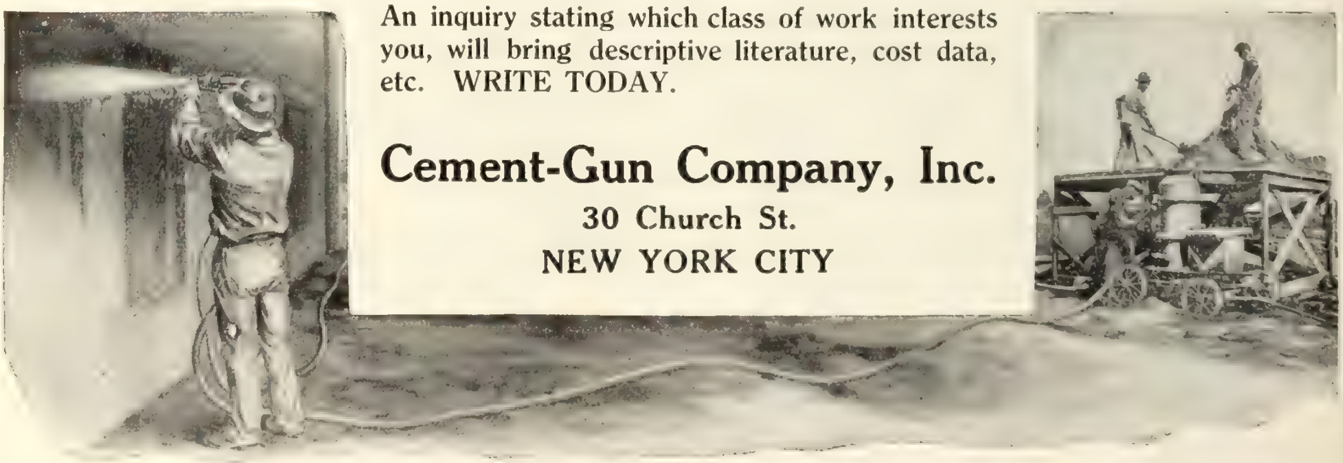

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Corporation Employees and the War

"Shame on the false Etruscan who lingers in his home
When Porsena of Clusium is on his way to Rome!"

ONE of the members of that august body, the Institution of Civil Engineers, commends the action of the City of London Corporation in refusing to increase the wages of employees who are of military age. While not in sympathy with compulsion, he deplores the fact that in Great Britain there are a large number of men who, from one cause or another, are shirking their duty. He tells us that there are still left many men of military age doing work which could be performed equally well by old men or by women. "To encourage such men by increasing their wages at this juncture," he writes, "would be unpatriotic and ill-advised, and would be putting a premium on pusillanimity."

In this view the Contract Record concurs. There is not a little in the sentiment which applies to Canada and to conditions here. We are all interested in the idea of maintaining the business stability of the country as far as possible, and in no field of endeavour is this idea of greater appeal than in the constructional field, whose ramifications are so broad, and whose activities embrace so many branches of work, but it were treasonable at such a time to place private enterprise before the great enterprise upon which the country and the Empire are embarked. It is to be regretted that in Canada, also, able-bodied young men of military age are hanging on to their jobs in the constructional and every other field, the while middle-aged and elderly men are filling the ranks of the unemployed. Toronto and Montreal alone are harbouring thousands of men between the ages of eighteen and thirty-five, whose places could be filled, with honor to themselves and advantage to the country, by men a generation older.

Considerable Work in Progress

The German menace is not going to halt building and engineering work in Canada, and it behoves each of us to do his part in keeping business conditions on an even keel. It was to be expected that there would be a great falling-off in constructional work, but it must not be imagined for one moment that things are at a standstill. A careful perusal of these pages week by week will disclose appreciable activities on the part of both the Government and the public. The Government is doing its part and the municipalities are doing theirs, while the man in the street shows a reasonable disposition to take advantage of the unexampled opportunity of building now with economy and profit.

But, be it noted, these reflections in no wise affect the larger issue. For able-bodied men a well-defined path of duty is marked out, and there should be no need to make the way more attractive by alluring pictures of reward of any kind. For an eligible man having no disabilities, physical or otherwise, to stay at home and let others fight for him is to play the part of a poltroon, and certainly such a part should not be encouraged even to the extent of security of tenure in his employment—let alone increase of pay.

"M. Inst. C. E." concludes with these significant words: "The fact is that England is too safe, thanks to our splendid Navy and to the absence of frontiers, but there may be a rude awakening some day if the manhood of this country do not realize that every bit of energy we possess must be used in only one direction until the awful shadow, which of a surety now threatens us, is dispersed. The only way in which this can be effected is by every man of fighting age in the country taking his part in the war."

Nine-Tenths of the Advantage to America

It is, of course, futile for laymen, or even statesmen, to talk of the terms of peace before the end of the war is in sight, writes J. E. Yerbury, in a communication to The London Builder; but, however severe they may be as against Germany (and perhaps the more severe the better for her in the long run), the rest of the world will still be faced with the competition of the German-speaking population of the Middle Empires, more closely bound together than ever before, the best organized, and the most highly commercially trained population in the world, which in a very short period after the war will compete, even more keenly than before, in all the markets open to them; and, in the opinion of many business men, the loss of her commercial supremacy will be of short duration to Germany, unless the methods (or want of method) of the past are thrown over by English manufacturing firms. And even during the period of Germany's loss it will be America and not England that will gain.

American firms are paving the way for future commercial activities, but it is doubtful if English firms are doing more than marking time during the war period. If the people of this country had only had sense enough to have listened to Lord Haldane a few years ago, when he started his crusade for better commercial education and training, we should be in a position to take up our task after the war, and even yet there may be time to prepare for the commercial war which will follow the declaration of peace.

Education and training are at the bottom of German commercial supremacy, and until we adopt a system which will meet the requirements of every class we must be content to see America take nine-tenths of the advantage lost by Germany.

The Engineer—A Constructive Criticism

As I see it, says a writer in The Engineering News, one of the greatest faults of the engineer is that he relies too much on his technical training, and confines himself to an entirely too small a field, taking little interest in the affairs of the day outside of his own chosen profession and not mixing with clubs and organizations as other business men do.

Surely there is no business or profession which is more certainly founded upon sound business principles than is engineering. "Engineering is the theory of economy" expressed in a few words. No engineering business can ever be truly successful until it takes on a sound business system. We have often heard that an engineer is "a man who can do for one dollar what any fool can do for two." How can this be true unless, in addition to technical engineering knowledge, a man employs business methods in his calculations and transactions?

Most engineers are inclined to lack confidence in themselves when it comes to mingling with men of affairs, or else their outward demeanor does not show that this is not the case. We cannot expect to always talk "shop," and in our intercourse with men it is exceedingly important to our success that we be able to converse on other subjects. It is the big, broad man who accomplishes things in this day and age, and we must enlarge our field and become conversant with the events of the day.

We have read a great deal of late in the engineering publications on the subject of public speaking by engineers. Right here is one of the greatest failings of the men in our profession. The engineer should train himself to speak in simple, well-selected, plain words, and be able to show his hearers the advantage to the community at large of engineering works. Surely there is no other profession which should be more interesting to the public than engineering, but the great trouble has been that we have not been trained to present our side of the case.

The engineer should be versed in legal procedure, labor conditions, social problems and all general questions of city, state and country. In order to be successful, he must be able to express himself in good, clear, sound English, and not simply sit back with the air that "I am an engineer and I can make no mistakes," or "you must take my word for it, for you would not understand even if I tried to explain, because you have no technical education."

I have found that the knowledge of legal procedure relative to public improvements which are constructed from funds derived from bond issues or special assessments is one of the most valuable assets.

The writer believes that technical schools could not make a better move as an improvement in their courses than to include one on public speaking. If every student of engineering were required every so often to deliver a lecture on his subjects he would soon lose his "stage fright," and this training would be of incalculable value in life later.

A concrete barge has been in service on the Welland Canal for four and one-half years and during that time has been subjected to severe service. It is used in canal maintenance work and at times riprap, in loading, has been dropped on its deck from a height of 12 feet. The scow, which was built in November, 1910, is 80 ft. long, of 24-ft. beam and has sides 7 ft. high. The hull is divided into eight compartments by one longitudinal and three cross bulkheads. There are 2 x 2½-ft. openings through the cross bulkheads. The deck, bottom, sides and bulkheads are 2½ in. thick, reinforced in both directions by ¼-in. round rods on 2-in. centres. Beams 6 in. square on bulkhead lines, reinforced with heavier steel, as required, and braced by reinforced-concrete posts, care for the principal stresses. The concrete is a 1:4 mix, using small gravel. The boat was designed and built under the supervision of Mr. J. L. Weller, then Superintending Engineer of the Welland Canal, and now Engineer-in-Charge, Welland Ship Canal.

Investigation into the condition of the concrete in some of the forts in Belgium which the Germans took after a much shorter period of attack than was expected, appears to show that the work was by no means well executed. The last report in connection with the forts around Antwerp and also at Namur is that while the plans and positions were of the best and the ordnance used to defend the forts were beyond criticism, the steel and concrete and stone work were of poor quality. For instance, at Namur the concrete supporting one steel turret was so poor in quality that it was demolished by a single German shell.

The Fortress of Heligoland

IN an interesting article which tells of how concrete and steel have been employed by the Germans in fortifying Heligoland, a writer in Ferro-Concrete observes that about a quarter of a century ago Heligoland was foolishly handed over to Germany by a Government who were so misguided as to suppose that the act would be regarded as an evidence of friendship. Far from taking this attitude, the Germans considered our action to be the result of fear, and at the same time laughed up their sleeves at our folly. To-day the German character is a little better understood by the British people, but quite recent events have shown how difficult it is for those in authority to shake off the traditional policy of trying to placate a savage enemy by kindness.

Twenty-five years ago, Heligoland was being rapidly eaten up by the sea, and the idea of preserving and fortifying it does not seem to have occurred to our peaceful rulers. As soon as the place came into the possession of the Germans, steps were taken for the preservation of the island, and its conversion into a powerful fortress for the defence of their shores and an important naval base as a menace to England.

Painstaking Construction

With their accustomed systematized patience, the Germans set about the heavy and laborious task of stopping the ravages of the sea. Groynes and breakwaters were constructed at various points to break the force of the waves and to alter the course of the currents which were undermining the cliffs. In places where the inroads of the waves were particularly threatening, granite sea walls were built, some of these being from 30 to 40 ft. high and from 16 to 20 ft. thick. Then, while these operations were in progress, the island was literally stuck together with cement grout and ferro-concrete. Thousands of tons of these materials were used for filling cracks and crevices in the cliffs, and it is stated by a visitor to Heligoland in 1912 that "the Germans went round the island just as a painter goes round a house, and filled in all cracks. and in some places they poured in 40 or 50 tons before the gaps were filled." As our readers are aware, the same kind of methodical precision has been displayed in the wanton destruction of Belgian and French towns during the present war.

Fortifying the Island

Next came the fortification of the island, which is undermined in all directions with galleries, lighted by electricity and leading to chambers in the face of the cliffs. Some of the chambers are for the operation of heavy guns and others for the storage of ammunition. The ordnance equipment is said to include several 14-in. guns and numerous 10-in. and 11-in. guns. Another interesting fact is that a considerable part of the island is protected by steel armour plating. The plates immediately outside one of the larger gun chambers are 8-in. thick and securely bolted into the rock. In order that they may escape detection the plates are painted of a reddish color to match the cliffs, and the various markings of the natural rock are so cleverly imitated that it is very difficult to distinguish the steel from the cliffs. Further, the gun emplacements are so skilfully hidden that they cannot be detected from the sea. The observation chambers are elaborately equipped with the most modern instruments and, of course, are in telephonic communication with all parts of the fortress. One of the devices for range finding is a large glass screen divided into squares, and on which is reflected a large area of the sea. The exact range for each square having been exactly calculated, it would be quite easy to concentrate fire on any hostile ship whose image happened to be reflected on one of the squares.

The island is further equipped with a Zeppelin shed capable of accommodating two airships, the shed being constructed to sink into a pit so that its roof is level with the earth, and, being painted to imitate the surrounding land, the top of the shed is almost unrecognizable from a moderate height in the air.

As a naval base, Heligoland is now provided with one of the finest artificial harbours in the world, built at a cost of more than a million pounds and capable of affording safe anchorage for an entire fleet.

With their customary thoroughness and foresight the Germans have not left undone anything that would help to make the island an impregnable fortress and an effective menace to Britain.

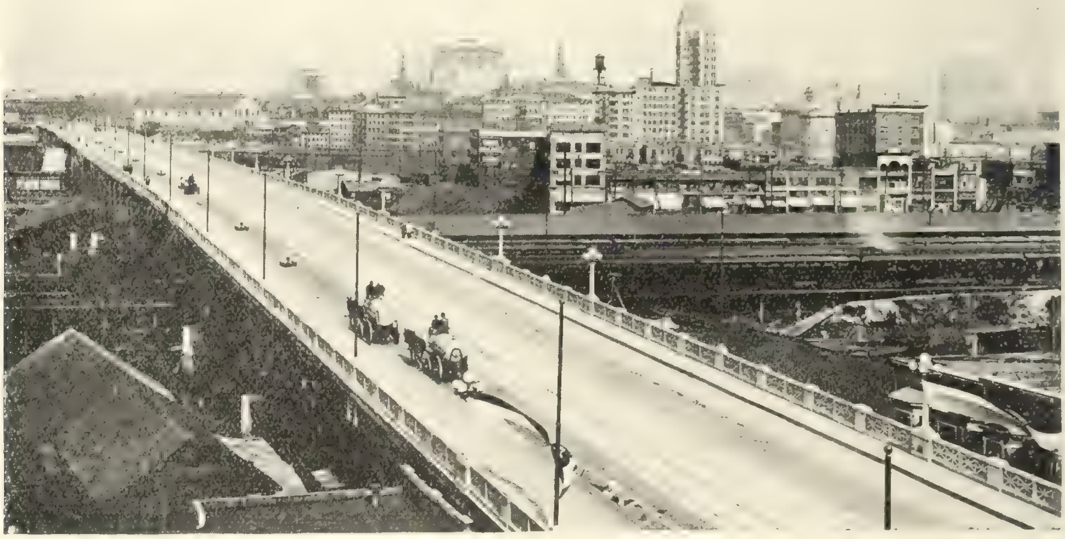
German Destruction

A pamphlet published by a Westerham printer gives a useful and complete account of the various acts of destruction of architectural monuments which have been committed by the German armies in Belgium and France, and the various resolutions of protest passed by learned and other societies, as well as the newspaper reports which have appeared in the press of various countries concerning them, the whole forming a stirring indictment of the barbarous conditions under which the German Government is waging the present war. The conditions as to the preservation of historic monuments in war agreed to by the signatory powers solemnly bind themselves to respect such buildings unless they are used by an enemy for purposes of war. The German reply in each case is either a denial that damage has been done, or else a statement that the buildings in question have been used for military purposes, and that therefore their destruction is warranted and excusable. Perhaps the most striking of all the documents referred to is the Report by Professor Clemen,, of Bonn, Chairman of the Commission on Historic Monuments in the Rhine provinces, which was written in December and published in the Journal of the American Institute of Architects in March, in which he states "that nowhere on Belgian ground have irreplaceable architectural works been lost," and goes on to explain that even among the horrors of war German art lovers may be assured that "such precious art possessions are safe in the hands of the German Government." Quotations of this kind show that it is useless to expect any recognition of the evil done or any help to prevent further damage from the German authorities, who do not scruple to describe Whitby and Scarborough as being fortified towns, and who would complacently describe the destruction of St. Paul's as a regrettable "military necessity." We do not think there is much in the suggestion made that neutralized zones should be created round historic buildings, as the policy which leads to the concentration of artillery fire on a cathedral would not regard the most clearly defined neutral zone as a greater safeguard. The real remedy appears to us to be put it beyond the power of Germany to place the peace of the world again in jeopardy, and to trust that the new boundaries of the European States which are marked out after the war may correspond with the aspirations of the people who inhabit them.—The Builder (London, Eng.).

The Georgia-Harris Viaduct, Vancouver,—the Longest Reinforced Girder Span in the World

THE completion of Vancouver's new viaduct has rounded out an exceptionally fine engineering effort in which utility, strength, beauty and economy—all duly considered—have resulted in a harmonious structure which is a feature of pride to the commercial metropolis of British Columbia.

Waterfront or port possibilities of Vancouver are in part an advantage and a handicap, for the waters of Burrard Inlet and False Creek had before the birth of the city so encroached upon the land that only a small neck permitting four highways was left to join the east and west sections of the city. Through these few streets rushed the great streams of vehicular and car traffic. Congestion resulted and a better means and more rapid intercommunication was sought.



The Georgia-Harris Viaduct, Vancouver.

The solution was found to lie in the erection of a viaduct which would not only shorten the distance to be traversed, but also permit continuous passage, an impossibility in congested areas where street intersections and the resultant cross traffic cause delays innumerable even under the effective direction of the traffic squad of police.

Construction was commenced in June, 1913, by Messrs. J. McDiarmid & Company, Limited, general contractors, of Vancouver, Calgary and Winnipeg, and completed just prior to the formal opening on Dominion Day, when this half-million dollar bridge was temporarily given the name of the Georgia-Harris Viaduct.

General Details

The viaduct, which runs east from Beatty Street to Main Street, is 2,860 feet in length, with a maximum grade of 3.11 per cent. at the east end, and 66 feet wide. Eighteen thousand cubic yards of concrete have entered into its construction, and nineteen thousand tons of steel. The roadway, which is double-tracked with 80-lb. steel rails on steel ties bedded in concrete, and which is 53 feet in width, required 1,500 square yards of paving—bitulithic and granitoid being used.

The trackage is the property of the city and will be rented to the B. C. Electric Railway Company, Limited, but it is not at present in operation, as the transportation company have been unable to complete arrangements for its use. The sidewalks are 6 feet wide, and, like the gutters, are of cement.

The spans vary from 25 to 280 feet, according to the requirements of trackage, lanes and other systems which it was desirable not to disturb, for this viaduct crosses streets, lanes, the C. P. R. and B. C. E. Railway yards, the G. N. R. depot and yards, and False Creek. Short spans are of slab or mushroom construction, and girder and continuous Warren truss construction are also used, according to the dictates of economy and needed strength. One of the spans required girders of reinforced concrete 83 ft. 6 in. in length, which is believed to be a record for bridge girder span constructions.

The actual construction cost was $500,000. This is exclusive of any amounts which have had to be paid for the removal of buildings and for other indemnity to property owners.

The whole structure is finished off with an ornamental rail, of which the lighting standards form a prominent and classic feature.

The engineers who had charge of planning and construction were:—Messrs. F. L. Fellowes, City Engineer; C. A. P. Turner, Consulting Engineer; A. P. Hueckel, Supervising Engineer; Jas. P. Kennedy, Engineer, and Thos. Borgford, General Superintendent at Vancouver for the contractors, Messrs. J. McDiarmid & Company.

Wood Block Paving in Montreal

By Dr. John S. Bates*

EARLY wood pavements of untreated blocks on plank foundations gave very unsatisfactory results in Montreal, as was the case in every other city where this primitive type of pavement was adopted. Pavements built in this city in the years 1889-1893 of tamarack blocks dipped in creosote gave comparatively poor service. The causes of such results are well known, and now, after years of experimenting with various methods of treatment and pavement construction, means of overcoming these difficulties are equally well understood. A short stretch of dipped block pavement remaining on St. Francois Xavier Street is an interesting relic of those early experiments. In its present condition it is of little use as a pavement, but it forms an impressive demonstration of what wood-block pavement should not be.

A wood pavement is subject to deterioration from two agencies: (1) mechanical abrasion from traffic, and (2) decay resulting from development of wood destroying fungi. It has been demonstrated during many years of experience in Europe and America that thorough impregnation with creosote oil, which acts as an antiseptic waterproof filler, affords effective protection against deterioration from both of the above causes. Without attempting to discuss in detail the various factors upon which the durability of a wood-block pavement depends, it may be said that service results obtainable from untreated or dipped blocks, where at best the penetration of the preservative is only superficial, are in no way comparable to those from blocks thoroughly impregnated under pressure, which is the universal modern practice. Untreated softwood blocks were everywhere abandoned for pavement construction long ago, and dipped blocks are now rarely, if ever, used. The use of pressure treated wood-blocks for pavement construction has been increasing consistently during the last six or eight years in European countries and particularly in the United States.

The outstanding merits of wood-block pavements are noiselessness, durability and low traction resistance. Because of these features, such pavements are particularly well adapated for busy city streets. Some of the world's most heavily-travelled thoroughfares are paved with creosoted wood-blocks. Those who have observed the wood-block pavements of the Strand, London, or of some of the famous streets of Paris or of lower Broadway, New York, must have been impressed with the excellent results there obtained. Toronto, Hamilton, and Ottawa all possess very fine examples of modern block pavements. During the last three years these cities have laid considerable areas of wood pavement with very satisfactory results, thus proving that such paving material is perfectly well adapted to Canadian climatic conditions.

There are two short stretches of block pavement recently laid in Montreal, which have been in service two years. These are located on St. Sulpice Street, south of Notre Dame, and on Bonsecours Street, south of Craig Street. While the length of service of these pavements is as yet insufficient to warrant any conclusions as to ultimate life, they will, no doubt, give very good results.

It must be significant to Canadians who are interested in the development of national industries to note that cities in England, with no native available timber, have been importing large quantities of Baltic pine for paving block manufacture and indeed have recently been investigating the possibility of securing such material in quantity from Canada. Canada has large available supplies of Norway pine, Douglas fir and other woods which are well suited for paving block manufacture, though at present less extensively used than the species named, and yet Canadian cities with a few exceptions are using a proportionately insignifican quantity of wood paving, apparently preferring to import large quantities of asphalt, asphalt block, scoria blocks and paving bricks. Surely there is a lesson in this situation for Canadian highway inquirers who are now in a position to benefit from the extensive experience of cities of the United States and Europe where wood-block paving has been sucessfully developed. It has been demonstrated beyond all doubt that wood paving is not a fad, nor is it a luxury, limited to high class residential streets. When properly laid with properly treated blocks it is a pavement which will give excellent service and the highway departments of Canadian cities would do well to carefully investigate its possibilities.

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*In charge of the Forest Products' Laboratories at Montreal.

Bituminous Paving

IN a paper dealing with the re-surfacing of main roads in tar, pitch and bituminous macadam (presented at the National Road Congress, held last month in London, Eng.) the authors, Messrs. Sheldon and Lyddon, give "some of the salient points of interest on which it is considered further information is desired before more extended use can be made of the class of paving referred to as bituminous." These are seven and are as follows:—(1) The effect of various kinds of soil on bituminous material under known conditions of traffic; (2) the desirability of a strong foundation where the character of the road justifies the use of a bituminous paving; (3) the suitability or otherwise of open mixtures for use as wearing surfaces in damp situations; (4) suitable and reliable tests for asphalt cements, either by penetration or other means; (5) the desirability of analyses and tests to be made on bituminous materials for known conditions of use; (6) the allowable limits of percentage of bitumen in mixtures containing various mineral aggregates; and (7) the cause and cure or amelioration of corrugations. These are then taken seriatim, the whole forming a very valuable series of "observations." Space allows of the presentation of only a few points here. Bituminous material should not be laid where clay will come into direct contact with it, as it is kept in a more or less moist condition at all times, and this causes serious local disintegration by a general softening of the material, which is soon broken up by the traffic. The importance of a strong sub-crust cannot be over-emphasized. While unable to advance a definite opinion as to the relative water resistant proportions of the mixtures containing various percentages of mineral aggregates and bitumen, experience indicates that, of mixtures made by the same bituminous binder, those which are densest appear to be the least affected by water action. The penetration test for uniformity leaves much to be desired, and the substitution of a needle square in section would make it more reliable than at present. Data appear to be necessary, to establish the maximum percentage of bitumen which a mineral aggregate having particles of known grade will hold without the mixture becoming saturated with bitumen, and conversely, the minimum percentage necessary to withstand water action and other disintegrating agents. Corrugations appear less on mixtures laid in thin layers; rich mixtures, containing comparatively high percentages of bitumen, should not be laid in layers of greater thickness than 1 in. to 1¼ in. to reduce corrugations to a minimum. All mechanically propelled vehicles appear to exert some influence in the form of waves, but the nature of the foundation of the road is a factor of importance, a yielding foundation, other elements being equal, conducing to the production of corrugations.

Progress in Sanitary Engineering

Specially contributed by Joseph Race, F.I.C., City Bacteriologist and Chemist, Ottawa

PROBABLY the most noteworthy event in the progress of sanitary engineering on this continent during the past year was the investigation of the International Joint Commission on the pollution of international waterways. Although the immediate question before the Commission is the legal one of the rights of both countries to receive water from the international waterways which shall not be injurious to health or property, there seems to be a tendency to waive a strict interpretation of the treaty and to permit such pollution as can be removed by reasonable methods of purification and that will not cause local or general nuisances. Probably riparian owners are entitled under the treaty of 1909 to water which is non-injurious to health and property in its **raw condition**, but this view seems to have been waived by all the interested parties on account of its unreasonableness and impracticability. If municipal and commercial development is to proceed, some measure of pollution must undoubtedly be permitted.

During the summer of 1913 the experts of the Commission examined all the international boundary waters, and the evidence collected demonstrates in an indubitable manner the nature, and also, in some instances, the source, of the pollution. The various reports that have been published by the Commission indicate the serious extent of the pollution at various points along the international boundary where urban communities are in close juxtaposition, but even where these conditions do not obtain, and where there is little danger of infection by other communities, the danger of auto infection by intermittent pollution caused by abnormal wind conditions still remains. It is clear that very few of the cities situated on the Great Lakes can procure a raw water supply from these lakes that can be guaranteed safe at all times. This, however, is a fact that is not yet appreciated by the public at large, and also, it must be added, by a few engineers and sanitarians. When a water supply becomes infected with disease-producing organisms and an epidemic occurs, there results a wave of action for remedial measures, but once this has passed the ebb sets in and public opinion once more subsides into lethargic indifference. Possibly the buoyant optimism of human nature—that the adverse conditions were abnormal and will not occur again—is largely responsible for this attitude. The public generally is not yet fully educated to the importance of the conservation of public health and is unwilling to spend the money necessary for this purpose. This is all the more pronounced when it is compared with the general attitude towards public works which affect the comfort of the people. Money in abundance can be found for the construction and cleansing of roadways but none for health schemes.

The investigation of the International Commission marked an important step in the advance of sanitary science in this country and it is a matter for regret that the waterways, other than international, are not being similarly treated by some department of the Dominion Government. If this were done, the Government would then possess reliable information upon which measures for the regulation of all waterways could be based. Such measures would probably be eminently practicable, in contradistinction to the provisions of the Bradbury Bill, which has been before the House for several years, and which, by reason of its striving for the unattainable, would be both ephemeral and futile. This is the view which the writer presented to the Bradbury Pollution Committee in 1913, and although somewhat unsympathetically received by the Committee, it is pleasing to note the evident intention of the Government to collect further data and opinions before enacting such drastic regulations as are proposed in this bill. The sanitary experts called upon to report on the bacteriological data collected by the Commission evidently consider that it is unreasonable to expect to obtain safe drinking water from surface streams and waterways without purification, and in this every sanitarian will concur. The natural corollary to this is the proposition that pollution of waterways should be permitted—providing that no nuisance is caused thereby, and that the amount is not greater than can be removed by reasonable methods of purification. The experts would insist on all sewage being screened in order to eliminate the larger, suspended solids, but consider treatment in oxidizing beds unnecessary on account of the general abundant sufficiency of oxygen in the waters into which it discharges. In cases where the sewage may cause unsafe loading of water purification plants, the experts recommend chemical disinfection or sterilization of the clarified sewage. The definition as to what is to be considered a safe load for purification plants is naturally a controversial point and one that must be regarded as subject to alteration as the evolution of water purification proceeds. The report shows that the experts of the Commission were divided in their opinions upon this point, although the great majority, five out of six, signed the report that the working limit was an annual average of 500 B. Coli per 100 cubic centimeters of water. The minority of one, concurred in all the recommendations of the majority report with the exception of the one regarding the safety limit for pollution, and expressed the opinion that this should be a **monthly** average of 500 B. Coli per 100 cubic centimeters. A superficial consideration would perhaps result in regarding this difference as that between tweedledum and tweedledee, but further analysis dissipates this view. Many supplies which are perfectly good purification propositions would have to be abandoned if the minority report were taken as the standard, although the present pollution might be increased severalfold before reaching the limit proposed by the majority report. This point is well illustrated in the diagram, which shows the

B. Coli in one of the best known Canadian rivers. The writer is of the opinion that although the monthly average basis of estimation is too severe in effect and ignores the fact that such waters can and are producing satisfactory supplies, the annual average method of computation is too lax and requires qualification or modification. If the index of pollution does not fluctuate very largely, the annual average of 500 B. Coli per cubic centimeter could be permitted without an undue strain upon the purification process, but if the difference from the mean are large, the factor of safety is considerably reduced. If the annual average basis were qualified by a clause providing that the B. Coli index shall not exceed a specified maximum during a limited duration of time, the report would meet with unqualified approval.

The investigation as a whole has been of immense importance, because it has shown the lines along which future developments in sanitary engineering are to follow for at least some years. The activities suggested are, primarily, water purification, and secondarily, the screening and chemical disinfection of sewage.

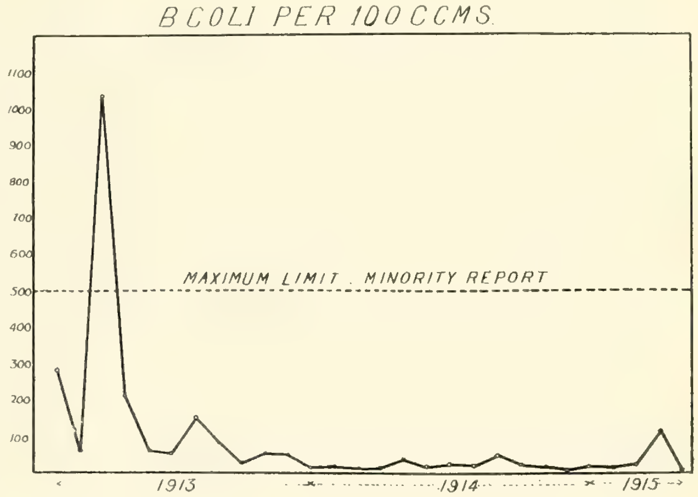
Water purification during 1914 has shown no radical alterations, the chief feature of the year being a tendency to increase the safety factors of plants by treatment with chlorine. This practice is now almost universal on this continent, over 400 millions of gallons a day being treated in this manner.

Liquid chlorine has been reported upon very favorably by several observers, and has, in some instances, been substituted for hypochlorite of lime. The superiority of this substance over hypochlorite to the amounts claimed by various people has yet, in the writer's opinion, to be substantiated. The secret of successful chlorination lies in efficient mechanical admixture, and whilst this has often been overlooked in the older installations using hypochlorite the full advantage of it has been utilized by the recent liquid chlorine installations.

The writer has followed this matter very closely and has found that considerable economy could be effected by close attention to this detail. At Ottawa he found that excellent results could be obtained by the use of hypochlorite of lime in the proportion of 1.5 parts per million of available chlorine, whilst in Montreal it was found by Harrington that a similar amount of chlorine was required when added as liquid chlorine for the treatment of the water of the Ottawa River. The excellent automatic chlorination controllers that are attachable to the Venturi meter recorders also guarantee a much better adjustment of dosage than can be obtained with liquid chlorine. The use of liquid chlorine is only justifiable when the increased cost of chlorine can be counterbalanced by reduced labor charges, or when local conditions do not permit the use of the hypochlorite of lime.

In water filtration the year was marked by the award of the Toronto extension to a company which is building filters of a rather radical type. This filter, the drifting sand type, combines principles common to both slow sand and mechanical filters, and if the results obtained on the large installations even approach those obtained with the unit experimented with at West Toronto, water purification will be revolutionized. The possibilities of this type of industrial purposes, and especially for paper makers, should be seriously considered. One of the essential features of this filter, and also of others well known in this country, is the elimination of the coagulation basin, with a consequent large saving in capital expenditure. Some sanitarians have held that considerable time is required for the production of a "floc" in water by the addition of alumina sulphate, but the writer has proved in a series of experiments, made in connection with a design for a plant for the Ottawa water, that the reaction is practically instantaneous. Although no floculation visible to the naked eye is produced in less than fifteen minutes, the reaction has taken place and the products of it can be removed by filtration. In selecting a mechanical filter design, however, due consideration must be given to the amount of impurities to be dealt with, as it is conceivable that these may be so large as to reduce filter runs to impracticable lengths, unless previously removed in a sedimentation basin.

During the past year the design of the slow sand filtration plant under construction at Montreal has changed to that of rapid filtration on account of the excessive increase in the capacity demanded by the increased consumption. It is singularly unfortunate that this has been necessitated and that there will be no large-sized plant of this type operated under normal conditions in this country. The other plant of this design, that in Toronto, has been so excessively overloaded that the merits of this system have never been tried out under fair conditions in this country.



Standardization of water statistics is another important feature of the past year. The Committee of the New England Water-Works Association that has this matter in hand has issued various forms for the standardization of data which should prove invaluable in the future if their adoption becomes general. Comparisons between different municipalities in the past have been very difficult, but the forms proposed eliminate largely this, and although considerable time and trouble may be involved in their preparation, every sanitary engineer should assist and co-operate in this movement.

The efforts of the Water Consumption Committee of the American Water-Works Association should also be encouraged. This committee has endeavored to obtain statistical data from various cities regarding the water-works undertakings and has tabulated and published the replies received. These tables show that the methods and practices of water-works are very far from uniform and that in many cases the water-works department is bearing a financial burden that is a legitimate charge upon the general rates. This is well illustrated by the payments or non-payment, usually the latter in cities where the water-works is publicly controlled, for hydrants. These are part of the means for securing fire protection, and although they are constructed and maintained by the water-works departments these charges should be transferred to the general rates. Private companies invariably secure compensation for such fire protection services, and in a few cases municipalities also derive some income from this source. The great majority of Canadian municipalities, however, do not contribute one cent to the water-works department, either for fire service or for water used in other municipal departments. The reason for this procedure is to be found in the fact that many properties which are exempt from the general rates are assessed for water rates, so that if a portion of the water-works charges were transferred to the general rates, the increase in the general tax rate would be greater than the reduction in the water rate—owing to the transferred charge being derived from a smaller assessment. If a test case were carried to the courts on this method of financial manipulation, a readjustment would possibly have to be made, but as the amount involved is small on each individual property, though relatively large collectively, years may elapse before legal proceedings occur.

The statistics for water consumption in various cities, as published by the committee, show that although those places having a large percentage of metered tapes usually show a low per capita rate, the rate is by no means proportioned to the percentage of meters. It is evident from the figures published that meters are but one of many solutions for the excessive per capita consumption problem.

The most important advances in sewage disposal have been in the direction of rapid oxidisation of sewage without the use of ordinary contact beds. Although nothing has been attempted in this country, several experiments are being conducted in the United States along the lines of the Manchester experiments of Ardern and Lockett. This method consists in the preparation of a sludge which promotes active nitrification and the addition of this activated sludge to the sewage, through which is blown large volumes of air. This process can be regarded simply as oxidation by air assisted by the catalytic agency of the activated sludge. As previously indicated, future developments in sewage disposal will consist essentially of screening and disinfection, but if the new oxidation process can be worked out at very low costs, there will be a large field for it as a preliminary to disinfection. The cost, however, must be less than that of the reduced amount of disinfector required.

The Dublin process of sewage purification, which consists of the addition and cultivation of yeasts (Saccharomycetes) on the sewage in suitable tanks, is not likely to be successful on this continent on account of the greater capital expenditure necessitated by the larger per capita volume of sewage, and also because the weaker sewage would be less suitable for yeast reproduction which is essential to the success of this system.

Various methods for the treatment and utilization of sewage sludge have been proposed during the past year, but as yet they have failed to produce practical results. These processes, like many others that have been advanced in the past, endeavor to utilize the nitrogen and phosphate content of the sludge by concentration and conversion into fertilizers. The proportion of these valuable constituents in ordinary domestic sewage sludge is so small, however, as to render concentration unprofitable, and until some entirely new process for the elimination of the high carbonaceous content can be secured, the old method of lagoon drying should be retained.

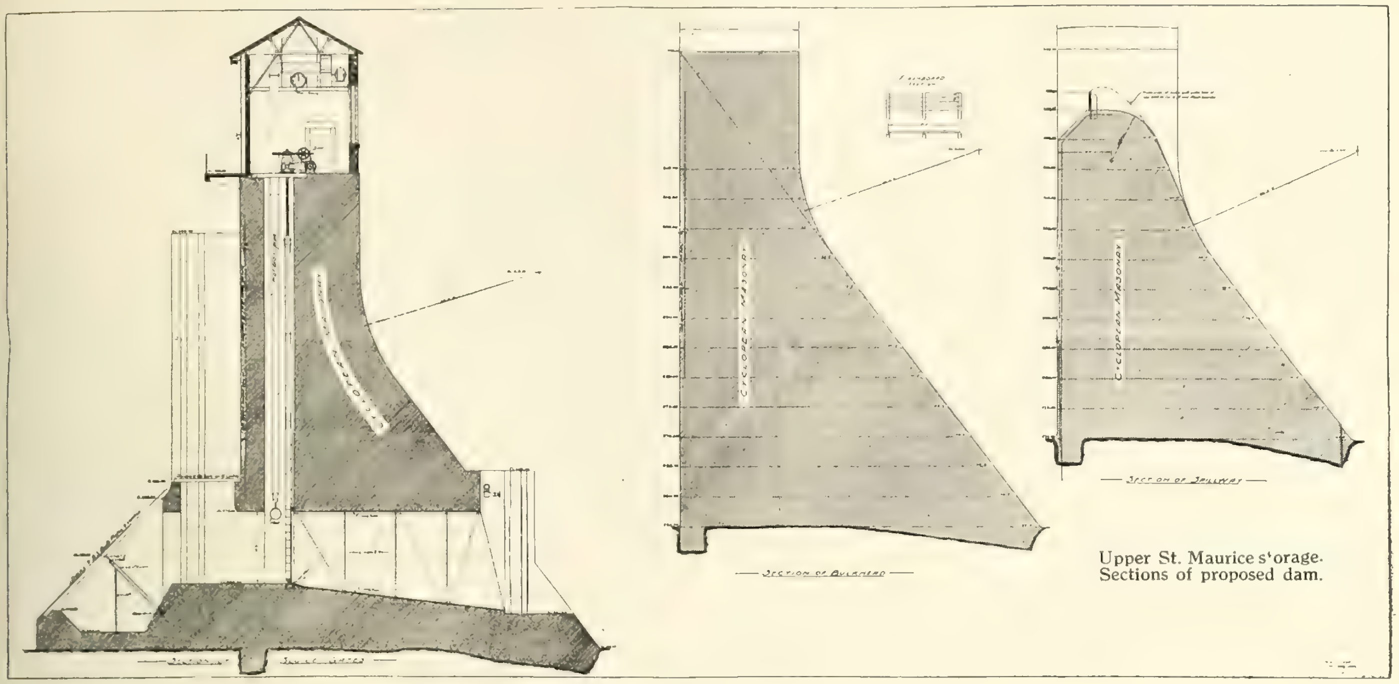
The economics of sewage treatment is a subject at present under consideration by the International Commission, and valuable results may be expected in the immediate future. This problem is one of immense magnitude and involves such enormous financial issues as to demand the attention of all who are interested in public health, if it is to be brought to a successful issue. Even if only general principles for the guidance of municipalities are the outcome, it will be an important advancement in sanitary progress.

During the year 1914 Mr. F. S. Krug, City Engineer of Cincinnati, made a service test of split granite blocks on a section of roadway 100 ft. in length. The results of this experiment were so satisfactory that Mr. Krug intends to resort to this plan whenever it becomes necessary to relay a granite block pavement. Briefly, the plan consists of splitting the old granite blocks into two equal parts which are relaid with the new surface exposed to traffic. The blocks are readily split, to form the new paving stones, by the use of hand tools. Besides possessing obvious economic advantages this plan makes a solid pavement and one less noisy than the one replaced. The surface formed is as smooth as is required for the heavy traffic common to granite paved streets.

The suggestion has often been made that steel should be painted before being embedded in concrete, with the idea of protecting the metal from corrosion. An investigation of this proposal has been conducted by Mr. H. A. Gardner, of the Institution of Industrial Research at Washington. One of the results brought out was the important fact that painting may have a distinctly prejudicial effect. One serious objection to the use of paint in reinforced-concrete work is its interference with the natural adhesion bond between the steel and the concrete. It is true that painted surfaces may be improved by being coated with crushed quartz or fine sand, but even then the presence of the paint is objectionable because it is interposed between two materials capable of entering into chemical combination, resulting in the formation of a rust-resisting compound which adds very greatly in the efficiency of the bond.

In connection with a factory building which has just been erected at Windsor, Ont., the method of floor construction is of more than passing interest. The walls of the structure are of brick, while the floor is of concrete, the latter being on a level with the concrete foundation. Below the floor level is a 3-ft. fill of gravel, which is laid as follows: A dam of sand was built around an area of convenient size, and this area was flooded with water and the gravel sprinkled with it. The height was raised in this manner 1 foot over the entire area of the building, and the operation twice repeated until the desired 3-ft. raise was accomplished. The point is made that as a result of this method of washing the gravel a very hard fill was secured. On top of this is a covering of maple flooring fastened to sleepers embedded in the concrete.

It takes the West to breed optimists. A trip over the prairies convinces Mr. George Bury, Vice-President of the C. P. R., that Canada will have a 240-million-bushel wheat crop this year.

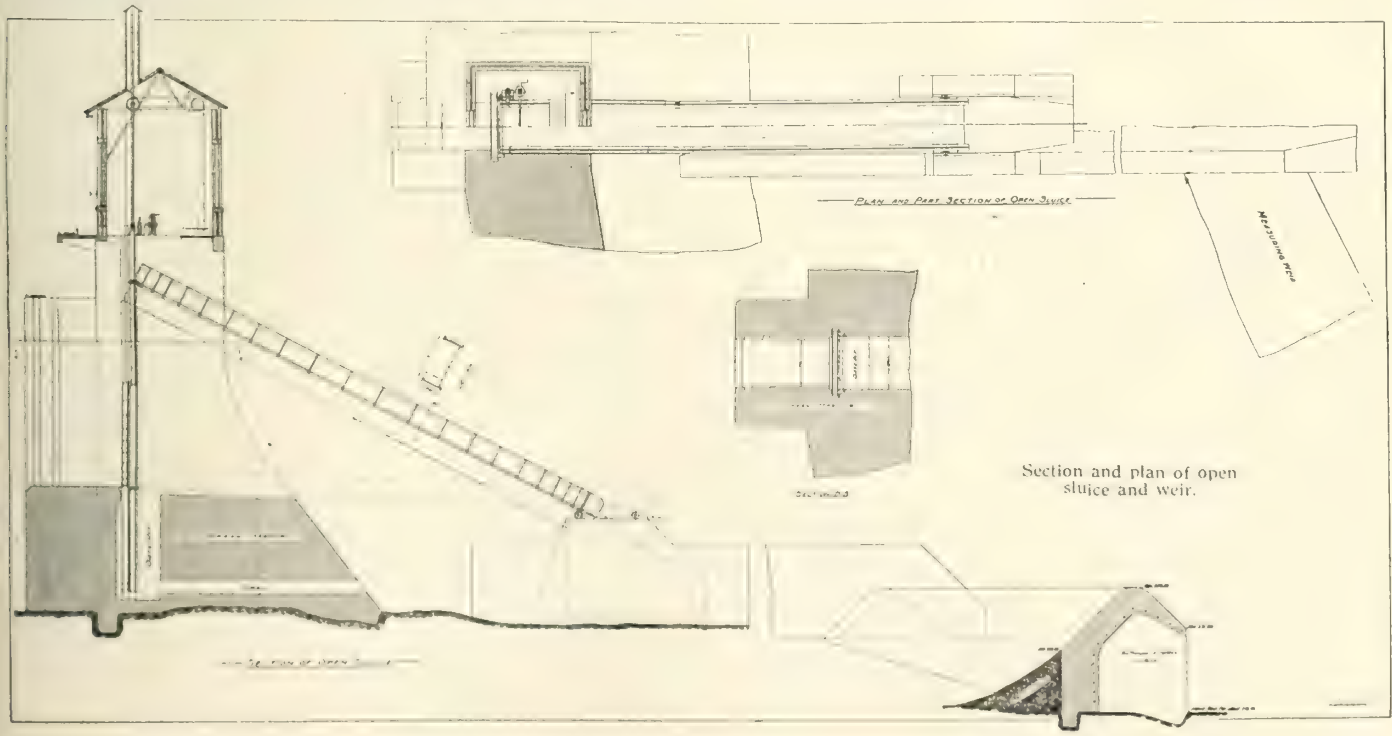


Upper St. Maurice s'orage.
Sections of proposed dam.

La Loutre Dam to Cost One and One-Half Millions

NINE tenders were received for the construction of La Loutre Dam on the St. Maurice River, at the mouth of the Manouan River, P. Q. The contract has been awarded to the St. Maurice Construction Company, Limited, of which Mr. Julian C. Smith, of the Shawinigan Water & Power Company and the Cedars Rapids Manufacturing & Power Company is President. It is understood, however, that the actual work of construction will be carried out by Fraser, Brace & Company, Limited, of Montreal. The contract price was $1,425,000, and the work, which will be commenced at once, is to be completed by January 1st, 1918.

The object of the dam is to store the waters from a drainage area of 3,650 square miles, the St. Maurice River having a basin of 17,000 square miles. The minimum flow at Shawinigan under present conditions is 6,000 sec. ft., but when the dam is completed the minimum flow at the same place will be 12,000 sec. ft. The dam is to be of the gravity type, mass cyclopean concrete. The upstream face will be vertical, and the downstream face will have a slope of 9 inches hori-



Section and plan of open sluice and weir.

zontal for 12 inches vertical from elevation 1,318. The plans show the length of the dam to be 1,720 feet, with a width of 20 feet on the top at elevation 1,335 and 60 feet at the base, elevation 1,355. It will rest on solid rock entirely.

A spillway to be provided at the eastern end will be 840 feet long. The flow will be regulated so as to maintain a minimum of 12,000 sec. ft. at Shawinigan through ten sluice gates, 12 feet high by 7 ft. 6 in. wide, located between elevations 1266 and 1278. The gates, which will be 20 ft. centre to centre, are to be made of structural steel, and will slide on a bronze surface. They will be operated by hand power only. These gates have been designed by the Dominion Bridge Company, and will be made by them. Stop logs can be used in case of repairs to the gates. In addition to the gates a log sluice opening will be provided. This will be closed by a structural steel gate. The logs will be passed from the level of the water in the reservoir to the level in the lower pool through a log slide, which can be lowered or raised according to the water level.

The original design provided for a generating station at the dam, but this portion of the scheme has been abandoned and is not included in the contract just let. The hydro-electric company will benefit considerably from the storage scheme. This will increase the power at Shawinigan over the low water year of 1906 by 32,000 horse power and will double the low water possibilities of the St. Maurice River at that point. The owners of water powers will pay an annual amount to the Quebec Government for this additional power, and agreements have been made which will insure an annual revenue more than sufficient to pay for the maintenance charges and the capital cost. The lumber interests will also benefit, as the dam will give a more regular flow of water, enabling the logs to be driven with greater certainty. The lumber companies will be called upon to pay an annual amount proportionate to the benefits derived.

The type of dam adopted was proposed by Mr. Edward Weggmann, consulting engineer, of New York, the details being worked out by Mr. J. W. Thurso, hydraulic engineer, New York. All the information and data regarding the site of the dam, the nature of the foundation, the flow of the river, estimates of the cost of the work, etc., were collected under the direction of Mr. O. Lefebvre, Chief Engineer of the Quebec Streams Commission, who will supervise the work of construction.

The Adequacy of Bituminous Roads

By G. H. Jack, County Surveyor of Herefordshire

IT is not possible to treat such a subject in a general way, for the reason that the conditions vary in every county, in every district, and indeed upon almost every line of road. A method highly successful under one set of conditions is a failure under another set, so that it is not safe to follow any lead without first becoming fully acquainted with all the factors, favorable and adverse, which exist upon the particular line of road to be dealt with. Experience as to the behaviour of bituminous surfaces is so varied, generally, as to point unmistakably to the fact that efficient and economical roadmaking and maintenance can only be assured by a very thorough knowledge of local conditions, and a mastery of such important considerations as the stability and drainage of the subsoil upon which the road is constructed, while unless new roads rest upon good natural or made foundations the behaviour of any bituminous surface is uncertain. Now-a-days, the choice of first-class surfacing material is very restricted, and there are not more than a half-dozen types which have successfully stood the tests which have been imposed by mechanically propelled traffic. There have been few contributions dealing with the subject of subsoils and road foundations. There is very little useful information to be derived from text-books, and what information is given is so meagre and expressed in such general terms as to be useless in practice. It therefore remains for every engineer to investigate and deal with the subsoil difficulties peculiar to his own sphere of influence. Whatever other influences there may be at work, he says, the widely different behaviour of Tarmac, tarmacadam and tar-grouted macadam "is largely due to the degree of density procurable. Where broken stone or slag is used, whether water or tar-bound, it is always noticeable that the quantity of binder taken up by the coating varies considerably, due to the space between the stones being greater in one spot than another. It is quite impossible, therefore, to expect in the case of tar-grouting an even distribution of the binder. As a consequence all tar-grouted roads soon show harsh patches, which become loose and troublesome under a moderate traffic. If the texture of the road varies, the wear must necessarily vary, and although patches of roadway remain quite good, other and adjacent patches are undoubtedly bad. As soon as this condition arises recourse is usually had to surface tarring, which heals the sores for a time but does not remedy the fundamental defect. It is the same to a much lesser degree with tarred macadam, although still less so when limestone is employed as against granite, for the reason that in the process of rolling the limestone crushes somewhat, and thus reduces the space between the stones. . . . . In the case of Tarmac, the interstitial space is reduced to a minimum, partly by reason of the properties of the slag and partly because it crushes slightly under the roller, which gives a hard and compact surface; such work is practically waterproof and therefore durable, but unfortunately rather slippery under certain climatic conditions. Slipperiness, however, is an accompaniment of all the best-known surfacing methods." As to corrugations, the author has noticed that the more yielding the binder the more wavy the surface becomes. "The corrugations are no doubt partly due to the rolling in the first place, but to a much less extent than the subsequent rolling and pushing of the traffic. The trouble is certainly not entirely due to the steam rolling, which is proved by the wavy appearance of hand-laid asphalt surfaces. It seems to me that all roads constructed of materials which have not the rigidity of granite setts or wood blocks, or lack the elasticity of such a material as rubber, must develop corrugations as a matter of course."

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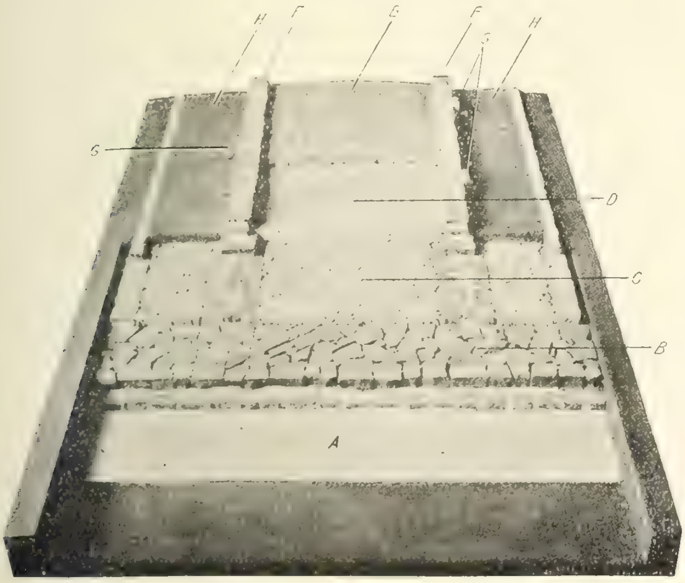
* Abstract of a paper presented last month in London, at the National Road Congress.

Roman Roads

THE Romans began building roads on a large scale more than three hundred years before the Christian era. The Appian Way, one of the most celebrated of their roads, was begun in 312 B. C., by Appius Claudius Caecus. This road led from Rome to Capua, a distance of 142 Italian miles. It was later continued to Brindisi, making the total distance 360 miles. Rome continued as a great road-building nation for about six hundred years, and fragments of some of its roads still remain. The Appian Way is said to have been in good condition more than eight hundred years after its construction.

The Roman construction was not uniform, though always extremely massive. The general form of construction employed during the reign of Caesar Augustus, when Roman road building seems to have reached its height, was a massive road from 16 to 30 feet wide, from 3 to 4 feet thick, and laid in 3 or 4 courses. The first course was almost invariably of large, flat, field or quarry stones laid on the earth subgrade, except in swamps, where poles, logs, brush, or even boards were used beneath the stone course. The other courses varied extremely with the available material and the period and importance of the road. Either small stones, with and without mortar, or gravel, broken brick, tiles, etc., were used for the second and third courses. The surface or wearing course consisted of well-cut, irregular, close-fitting polygonal blocks on a few of the more important roads, but more often it consisted of uncut stones, not unlike our cobblestone pavements, or of gravel, and in some cases of a mixture of sand and clay or clay and gravel.



From a photograph of a model of the Appian Way (300 B.C.)

Some of the more important roads near Rome were practically lined with temples, porticoes, and statues. On all roads inscribed milestones were placed at regular intervals.

The accompanying illustration shows a model of the Appian Way—the highest type of road constructed by the Romans. This model was exhibited recently in Toronto, at the last Canadian and International Road Congress.

Section A shows the contignatum pavimentum, composed of lime and sand, straw, rushes, or reeds, and sometimes laid on sills or boards.

Section B shows the statumen, or foundation, composed of two courses of flat stones laid dry or in lime mortar. The depth of this course was from 16 to 18 inches.

Section C shows the rudus, or rubble, composed of broken stone mixed with lime in the proportion of 1 part of lime to 3 parts of stone. Sometimes the material was taken from old buildings. This course was laid from 6 to 9 inches deep.

Section D represents the nucleus, composed of coarse gravel and lime used hot, or bricks, potsherds, or broken tile mixed with lime and covered with a thin layer of lime mortar.

Section E shows the summa crusta, or pavimentum, consisting of polygonal blocks joined with the greatest nicety. This course was about 6 inches deep and about sixteen feet wide.

Section F indicates the curbs, which were 2 feet wide and 18 inches high, with mounting blocks as shown at G. These blocks also served as seats for travellers.

Section H shows a side road, the surface of which was composed of gravel flushed with mortar. The width was from 6 to 8 feet.

Gravel roads in Kansas cost from 20 to 60 cents per square yard, averaging about $2,500 per mile for a 10-in. surface 16 ft. wide, where the haul does not exceed 2 miles, according to the latest annual report of W. S. Gearhart, State Engineer. Oiled earth roads cost from 10 to 20 cents per square yard, averaging about 15 cents. Waterbound macadam roads vary in cost from 45 to 60 cents per square yard; a waterbound macadam road 16 ft. wide, and with a surface 8 in. thick after rolling, will cost approximately $5,000 per mile under normal conditions. An oiled or bituminous macadam road costs from 10 to 25 cents per square yard more than waterbound macadam. Concrete paving costs from $1 to $1.30 per square yard. Brick roads cost from $1.50 to $2.25 per square yard, averaging about $1.75 where the haul is short. Sand-clay roads cost from $300 to $1,500 per mile for a 12-in. clay surface 16 ft. wide, the average cost being $800 per mile.

In the borough of Manhattan, New York City, the use of a sand cushion for granite blocks has been abandoned, according to information received from Mr. Eugene W. Stern, Engineer of Highways. Under the 1915 specifications a mortar bed is used consisting of one part Portland cement to three parts sand, mixed almost dry. The blocks, it is said, are brought to a proper surface by ramming just as readily as when the old sand cushion was used. The mortar hardens in a few weeks even under traffic. The great advantage of the mortar bed over the sand cushion, Mr. Stern states, is that surface water leaking through the joints of the blocks does not cause depressions in the surface, which was the case with the sand cushion, and the cost of maintenance is considerably reduced thereby.

A report by the general passenger agent of the New York, Westchester and Boston Railway includes the following statement:—"The multiple-unit coaches operated by this company weigh about 65 tons each, yet the passage of a train over a viaduct having a concrete bed is practically noiseless."

Data and Discussion on Leakage from Cast Iron Water Mains*

WATER leakage and waste may properly be divided into the following classes: (1) House or inside leakage due to defective plumbing. (2) Over-consumption, especially in summer. (3) Water stolen from the mains, and waste due to flat rates. (4) Underground leakage from services and mains. The first three sources of waste can and should be regulated by the installation of meters. This leaves only the underground leakage from services and mains for special consideration and serious study. During recent years several large cities have made exhaustive studies of the whole subject of water waste. The data here given will be confined to those pertaining to underground losses.

At Baltimore 60 per cent. of the leakage is charged to defective house connections, 20 per cent. to broken supplies, services and private pipes, and 20 per cent. to mains, valves and water used in street construction. These figures pertain to the high sections of the city and it was thought very likely that leakage from the mains direct would be found much higher in the lower parts of town. In New York City, in Manhattan and the Bronx, the waste detected and stopped from the fall of 1910 to April, 1913, was approximately 40,000,000 gals. per day. The underground leakage detected and stopped was about 25 per cent. of the total.

Very complete and thorough tests, extending over seven or eight years, have been made in the city of Washington. The data on underground leakage are so itemized as to show exactly the amount of loss from the different sources. During the seven years from July 1, 1907, to July 1, 1914, the underground leakage detected and prevented averaged 5,759,200 gals. per day. This was distributed as follows:

Sources of leakage.	Average daily leakage detected and prevented. Gallons.
1. Abandoned taps and services	140,843
2. Iron services	1,702,643
3. Lead services	611,600
4. Wiped joints	380,171
5. Couplings	825,871
6. Stopcocks	33,057
7. Street washers	8,371
8. Joints on mains	1,183,943
9. Broken mains	262,486
10. Valves	47,514
11. Blow-offs	142,986
12. Fire hydrants	51,100
13. Public hydrants	23,914
14. Unclassified	346,200

The foregoing tabulation shows the two principal sources of leakage to be from iron services and joints on mains. The former comprises approximately 29 per cent. of the total loss, or in other words the two combined represent one-half of the entire leakage. The loss shown in the case of couplings (which is the next largest) practically all occur in one year (1908-1909). Hence it is hardly fair to give this much weight. The loss from such a source should never be excessive. In most cases it is almost negligible. The losses both from lead services and wiped joints, while varying to quite an extent for the different years, are seen to be sufficiently large to warrant serious consideration. The other losses are rather variable and are not of so much importance.

The cases of Baltimore, New York, and Washington may be taken as typical. The results obtained indicate that the underground leakage represents anywhere from 25 per cent. to 51 per cent. of the total waste, but it must be borne in mind that the figures quoted represent only the amount of waste that was detected and stopped. Just what proportion of the waste was not detected or prevented we are not told, except in the case of New York. Mr. De Varona states that this represents only 15 per cent. to 20 per cent. of the total pumpage unaccounted for. Now in making such surveys as this it is much easier to detect leakages from services and house fixtures and waste occurring inside buildings than it is to detect leakages from the mains proper. As a matter of fact there is no reason why all inside loss could not be absolutely determined and this at a low cost. It would be a little more expensive to make such an investigation of the underground services, but this could also be done and the leakage from such a source determined. Then it is only reasonable to suppose—say in the case of New York for instance—where only 15 per cent. to 20 per cent. of the waste was actually accounted for, that a much larger percentage comparatively of the inside loss would be located and stopped than that of the leakage occurring underground, particularly from the mains themselves. As previously stated, if a water works system is properly metered, the inside waste ceases to enter into the problem. When a consumer is paying so much per thousand gallons for the water he uses, he will see that the plumbing is in good shape and that over-consumption is stopped.

It is a very difficult matter and in many cases practically impossible to make a close examination of the mains underground. This would necessitate the tearing up of paving, as well as otherwise seriously disturbing street traffic. Such a condition would not be tolerated in a large city, and even if they were willing to suffer the inconvenience, the work itself would be too expensive. This leads the writer to conclude that in most cases the leakage from mains greatly exceeds the amounts which the surveys indicate. Where the soil is porous and the street well paved, particularly with certain substances like concrete or asphalt, a leak even of considerable size from the main would not be detected on the surface. The water could easily find its way to a sewer and would remain undiscovered indefinitely. There might be numberless leaky joints that would thus pass unnoticed. Even a careful examination of the system, unless the pipe were actually uncovered and examined, would fail to disclose the location of these, except in a general way. Hence it is almost impossible to determine the exact underground leakage from mains and the rather low percentage of loss from this source as shown in the report cited is probably accounted for in this way.

Recently Walnut Street, one of the principal thoroughfares of Kansas City, was repaved in the heart of the business section. There is a large supply main down this street and the writer observed that the city was going to the expense of uncovering the joints in this main and recaulking them. Unfortunately the writer has been unable to learn just the extent of leakage that was found and does not believe the city could furnish these data, but, since they went to considerable expense to repair the main, it is only natural to conclude that they felt the loss fully justified the cost of the work. The few joints that the writer examined showed that leakage did exist.

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*From the report (published by Engineering and Contracting) of a paper presented at the recent annual meeting of the South Western Waterworks Association by Joseph W. Ivy, of the American Cast Iron Pipe Company.

No matter how carefully joints are made, even by skilled workmen, a certain amount of leakage will always be found to exist. In a paper read before the New England Water Works Association September 9, 1914, Mr. E. G. Bradbury presents some very interesting data on the subject "Allowable Leakage from Water Mains." From a series of tests made by Mr. Bradbury on a large quantity of pipe laid under his supervision at Akron, Ohio, and also at some other points, he proposes as a standard of allowable leakage in newly laid cast iron water pipe an average of 100 gals. daily per mile per inch of diameter of each complete contract or district with a maximum limit of 200 gals. daily per mile per inch of diameter. Mr. John H. Gregory specified at Columbus, Ohio, a permissible leakage equalling approximately 520 gals. daily per mile per inch of diameter, and justified this allowance with the statement that "the limits of allowable leakage specified were not guessed at, but were determined after careful study of the measured leakage in pipe lines with which the writer was familiar." The New York Aqueduct specifications allow a loss of 2 gals. per foot of lead joint, which is equivalent to approximately 240 gals. per mile per inch of diameter. Burns & McDonnel, of Kansas City, who have supervised the construction of some three or four hundred water works systems throughout the Middle West, in their tests allow a leakage of 80 gals. per mile per inch of diameter.

Now if we make an average of the allowances as prescribed by the authorities cited above, we find this to be 235 gals. per mile per inch of diameter. This, it must be borne in mind, takes into consideration only the actual leakage from the joints of the mains themselves where these mains are freshly laid and, therefore, at their best. Pipe systems necessarily become less efficient with age and the natural tendency would be for this joint leakage to increase with age. Just what the amount of this increase would be, it is almost impossible to determine, for as already explained, main joint leakage is so distributed as to make examinations, tests and repairs practically out of the question. However, this does not lessen the serious losses that now occur.

Unless applied to some concrete example, figures such as the above do not mean a great deal. Hence for the sake of illustration the writer will apply these to a city of, say, 100,000 population. In such a town the average diameter of the pipe would probably be about 10 ins. The amount of mains, say, about 200 miles. The loss per day would be 470,000 gals. The loss per day would be 470,000 gals. Figuring the production cost of the water at $50 per 1,000,000 gals., this would represent a loss of $23.50 per day, or $8,577.50 per year. Allowing 6 per cent. for interest and sinking fund, this would capitalize at $142,958.

This, now, represents only the minimum loss from joints alone in a newly constructed system, which is supposed to be built in the best manner possible. With age, even in a properly constructed system, joint leakage undoubtedly increases. The writer believes that during the life of the ordinary system, it would be only fair to average the loss at double the minimum when first tested, or say place the total joint leakage at 500 gals. per inch mile per day. Apply this to the foregoing case, we find the yearly loss to be $18,250.00, or at 6 per cent., an investment of $304,166.66.

Now in addition to the joint leakage we must take into consideration the following sources of underground loss: 1. Hydrants and valves. 2. Service connections. 3. Leaks, defective mains, dead ends, and "sweating."

In a paper read before the American Society of Civil Engineers, the late Emil Kuichling (Trans. Vol. 38), set the well known standard of one drop per second from each joint on a main; five drops from each hydrant or valve; and three drops from each service pipe, as a fair average in a properly constructed system. Now whether or not we may differ with Mr. Kuichling as to the actual loss per second, the ratio assigned by him seems to be well taken and tests tend to verify this. Hence the writer feels justified in making use of it here.

Most pipe in use at the present time is made in 12-ft. lengths. In the case of the city previously cited with 200 miles of mains, this would mean 88,000 joints. Figuring a service connection every 65 ft. would give us a total of 16,240 connections. Estimating a hydrant or valve every 300 ft. gives us a total of 3,520. By applying the ratio of leakage suggested by Kuichling, and reducing to the same unit, we have:

Pipe joints ... ... 88,000 x 1 = 88,000 units
Service connections ... 16,240 x 3 = 48,620 units
Hydrants and valves ... 3,520 x 5 = 17,600 units

Or, letting 100 per cent. represent the three sources of leakage, we find same to be divided approximately as follows:

Pipe joints	56 per cent.
Service connections	33 per cent.
Hydrants and valves	11 per cent.

Taking the value of 500 gals. previously determined in the case of pipe joints, we arrive at the following results:

	Gals. per inch mile per day
Loss from joints on mains	500
Loss from service connections	300
Loss from hydrants and valves	100

This brings us to the question of leaks by reason of defective or cracked mains, dead ends and "sweating"—a very hard thing to determine exactly in a general way because what is true in the case of one system might not be true of another—hence any loss that is assigned to such sources is much in the nature of an expression of opinion. There is little to substantiate or prove what might be said. However, as to defective mains, experience has shown that this need not be considered in the case of cast iron, once they are thoroughly tested and accepted, for there does not seem to be any case on record where they have rusted out under ordinary conditions, even after a century or two of service. There is doubtless in many cases considerable leakage at times because of cracked or broken mains, but such losses are only temporary in most instances as they are easily discovered and repaired, therefore the loss is not serious. The writer can find no reason for believing that dead ends are a source of much waste, yet some authorities seem to think—just why it is hard to understand, provided the system is properly inspected. The question of "sweating" seems to be a debatable one; certain tests made at Philadelphia several years ago on a 24-in. main under a pressure of 200 lbs. indicate that this is rather large. The writer has been unable to find any other tests to bear this out in the case of ordinary pressures. Under high pressures—say 1,500 to 2,000 lbs. to the square inch, there is quite a noticeable tendency for the water to be forced through the walls of the mains, even in the case of cast iron where the metal is an inch and a quarter or more in thickness.

Now, as previously stated, the loss from the causes enumerated and discussed in the foregoing paragraph is largely a matter of local conditions and, at best, only the expression of a personal opinion of what the loss should be. In the case of a well built system, properly kept up, the writer considers a loss of 100 gals. per inch mile per day as a liberal allowance from such sources. Assuming this, then, as being a fair estimate, we have losses from legitimate sources (no account is here taken of "steals" from mains, because it is a question that cannot be properly dealt with as applying generally) determined as follows:

	Gals. per inch mile per day.
Loss from joints on mains	500
Loss from service connections	300
Loss from hydrants and valves	100
Loss from other sources	100
Total	1,000

Applying the above results to the concrete example previously cited, i.e., to a city of 100,000 inhabitants with an estimated length of 200 miles of mains, average diameter 10 ins., water cost of $50 per 1,000,000 gals. and money figured at 5 per cent. for sinking fund and interest:

Source of loss.	Loss for yr. in gals.	Value at $50 per million gals	Represent at 6 an investment of—
Joints on mains	365,000,000	$18,250.00	$304,166.66
Service connections .	219,000,000	10,950.00	182,500.00
Hydrants and valves.	73,000,000	3,650.00	60,833.33
Other causes ... .:.	73,000,000	3,650.00	60,833.33
Totals	730,000,000	$36,500.00	$608,333.32

In other words, the city would be justified in spending $608,333.32 to save the leakage from the mains, and a proportionate amount to reduce it. Of course it is almost a physical impossibility to make the mains "bottle tight," but it is possible to reduce the leakage materially.

The writer understands that several manufacturers are either making at the present time, or preparing to make, pipe in 16-ft. lengths. Under the circumstances it would not be amiss to call attention to the fact that the use of 16-ft. pipe would necessarily reduce the loss from joint leakage 25 per cent. The exercise of more care in caulking and alignment, and the testing in open trench where practical would also tend to reduce loss from this source. More stringent regulations regarding the making of service connections and proper care in doing the work and examination of frequent intervals thereafter would unquestionably eliminate much of the waste. The same thing, of course, applies to other causes of loss. The writer believes that fully two-thirds of the leakage as determined in this article is entirely unnecessary and might be prevented at a cost which would undoubtedly represent a saving to the city.

Why One Contractor Will Bid Higher the Next Time

"When the mixer starts, Hell breaks loose. The engineers take delight in standing by until we are ready and then in finding something to delay the work while the mixer crew waits." Such is part of a superintendent's report, explaining his bitter disappointment to his contractor employer for placing less than 400 cu. yd. of concrete in two months on a Government contract that could easily be pushed several times as fast. The superintendent further explained that it mattered not how true or how well forms and steel were placed, the work was never done correctly unless it was done the engineer's way. His way always cost more and there was no arguing with him that another method would produce equal results. Surely a remarkable report coming as it did from one of the oldest employees of a firm of contractors noted for fairness and ability to do good work. If the contractors were not well acquainted with their superintendent they would be inclined to think he was partly to blame, but difficulties of this kind have never risen before in the twelve years of his employment, and careful investigation on the job showed that the report was not exaggerated.

A few notations on the form sketch sent in by the superintendent indicate the needless care with which the structure had to be built. Concrete in side walls, only 11 ft. high, could not be poured from the top but had to be deposited in several layers, the upper panels of the forms being left off for that purpose, thus causing much delay. All forms were required to be set within ⅛ in. error and bars within ¼ in. The forms were complicated beyond possibility of description here.

The superintendent wound up his letter resignedly with the characteristic attitude of his company, "We will do the best we can." The contractors state that they instructed the superintendent to get the job done the engineer's way. But they added that this is the reason why work for this particular department of the Government costs so much more than private work. If this firm can again be induced to bid for work in this department, the prices will be considerably higher than those of the present contract. Of course, the occasional isolated case like the above gets more publicity than half a hundred regulation contracts where give-and-take, fair-and-square methods of procedure obtain. While anathemas are heaped on the unreasonable engineer, this is not the end of the story, for irreparable damage is done to the whole profession and to the particular organization with which he is connected. The news of his unreasonableness is sure to spread among contractors, and his attitude will be imputed to the department which he represents.—Engineering Record.

In excavating for the new Pier 2 of the Intercolonial Railway at Halifax, N.S., a number of old pile stumps were found. These stumps were the remains of piles which had been eaten through by limnoria below low-water level. It was found that uncreosoted lumber was eaten from extreme low-water down to the mud level even when that was 30 ft. below. Several creosoted hard pine piles that had been in the water about four years were found to have been attacked to a depth of about ½ in. No signs of the teredo were found; apparently, all of the boring in this harbor is confined to limnoria.

An Earth Dam for Water-Works Reservoir

THE accompanying photograph illustrates the work in progress on an earth dam for the new water-works. As the view shows, the dam is Ashby Reservoir of the Fitchburg (Mass.) being built just below an old dam which held back the water to a depth of about 9 feet to form a storage reservoir for water power uses. The new dam will have a maximum height of about 28 feet, the greater depth of water being 22 feet.

The dam will have a total length of about 1,100 feet, and will consist of an earth embankment containing a thin reinforced concrete curtain wall. The view shows the excavation of the trench for the construction of this wall or cut-off to such depth as may be required.

A knoll divides the dam into two portions of approximately equal length. A cableway crosses the main valley from this knoll to the hillside, and is being used in the excavation of the curtain wall trench. The excavated material is dumped into cars on a short railway running along the side of the knoll, and such as is unsuitable for use in the embankment is used in filling low land below the dam. Later, the cableway will be utilized in transporting concrete from the mixer to the forms in the trench, and for depositing at least a portion of the borrowed earth in the embankment.

Fitchburg waterworks.—Earth dam under construction.

Centrifugal pumps have been set up to care for water in the trench, but thus far there has been no difficulty in handling all the water by the intermittent operation of a pulsometer.

The cableway engine is located in the shed at the foot of the tower in the distance. The boiler on the old dam furnishes steam for the operation of the pulsometer and centrifugal pump, and also for lifting the water required for sprinkling the embankments during construction. The old dam will be removed as far as it is in the way of the new construction.

A considerable amount of the planks and timber required for construction has been sawed, by a portable mill, from the trees cleared from the reservoir site. The smoke shows where the brush and stumps are being burned.

The work is being done for the water department of the city of Fitchburg, from the plans of Messrs. Metcalf & Eddy, Consulting Engineers, of Boston, and under their advisory supervision. It is in the immediate charge of Mr. Ernest E. Lothrop, City Engineer. The E. W. Foley Contracting Company, of New York, are the contractors.

We are indebted to Messrs. Metcalf & Eddy for our information.

In a paper read to the Boston Society of Civil Engineers, Mr. Leonard C. Wason, M. Am. Soc. C. E., gives the practical solution adopted in the case of a somewhat unusual problem. In connection with the construction of a lofty tower it was required that the walls and two floors near the top should be monolithic and perfectly watertight, so as to obviate the penetration of moisture in driving storms. Each floor has an area 28 ft. by 30 ft. and carries a load of 400 tons, the floor being supported on a main girder with secondary beams running from it to the opposite walls. The specification required absolute prevention of all cracks, impermeable concrete and as nearly continuous work as possible. Under ordinary conditions there would be frequent joints between the work done on successive days, and these might have allowed the penetration of water. The problem was solved by adopting somewhat lower working stresses than those customary by designing special moulds for depositing a large amount of concrete at one time, and by continuous work with different shifts of men, combined with very close supervision. The result, as stated by the author, proved satisfactory in every way.

Sand and cement (or dry mortar) cushions are used extensively for wood-block, asphalt-block and recently experimentally for granite-block pavements. Mr. D. Moomaw, Road Engineer of Cuyahoga County, Ohio, is now experimenting with a dry mortar bed for brick pavements. The sand and cement are mixed dry in the proportions 1:3 and spread to a depth that when struck and rolled a 1-in. cushion is formed. A hand roller weighing 250 lbs. is used. The preparation of the sand-cement cushion proceeds ahead of the placing of the brick only so far as the pavement can be completed before shopping work for the day. The bricks are rolled only enough to obtain an even surface, and when the rolling and culling is completed the pavement is sprinkled from a spraying nozzle until sufficient water is applied to insure wetting the cushion to its entire depth. Grouting the joints follows the wetting of the cushion and is completed as far as the blocks are laid. If weather conditions do not permit grouting on the day the bricks are placed, the pavement is covered and protected against rain and wash.

Refuse Incinerator Guarantees Too Strict for Practical Fulfilment

Liberal Interpretation of Specifications Necessary for Acceptance of Plants Under Prevailing Contract Terms—The San Francisco and Atlanta Cases

THE decision of city officials in Atlanta, Ga., and San Francisco, Cal., to reject high-temperature refuse incinerators, because of the failure of the plants to fulfil certain guarantees under test, has brought the character of the specifications into question, says a writer in The Engineering Record. High-temperature refuse incineration is a comparatively recent development in this country. The first plants were built at Westmount and Vancouver in Canada, and at West New Brighton, N. Y., and Seattle, Wash., in the United States—all of which were constructed between the years 1905 and 1908.

These plants were all patterned after English design, and, in fact, were built indirectly through English concerns. A larger plant, with a capacity of 300 tons per day, was completed for the city of Milwaukee in 1910. Since that time, no less than eight of these plants have been built in this country, with capacities ranging from 50 to 250 tons per 24 hours. In this comparatively short time, rapid progress has been made in the design of the plants, particularly as relates to the mechanical handling of the refuse to be burned, and the clinker resulting from the combustion. All of the plants of this type in this country, however, are similar in the general principles of design, construction and operation.

Specific Guarantees Required

The first four plants built were let under lump-sum contracts without special guarantees of operation or steam production, and the bids were compared on the first cost of the plants. The first specifications, typical of those now in general use for high-temperature incinerators, were used at West New Brighton in 1907 and at Milwaukee in 1909. The Milwaukee specifications left the design of the details of the plant to each bidder, protecting the city by requiring guarantees of operation along certain definite lines, very much as the performance of pumping engines is guaranteed.

The specific guarantees required may be summarized as follows: (a) That no nuisance be created during the ordinary operation of the plant; (b) that no odors, obnoxious gases, smoke or dust escape from the chimney; (c) that the temperature of combustion shall not fall below 1,250 deg. Fahr.; (d) that the residuum from the furnaces be thoroughly burned, hard and free from organic matter; (e) that the rate of combustion meet the statement guaranteed in the bid; (f) that the rate of evaporation in the boilers be not less than was stated in the bid, and (g) that the labor cost per ton be not more than was stated in the bid.

These guarantees have since been included in practically all specifications for high-temperature refuse incinerators. Certain modifications of expression have been used for each locality, but the essential features of the guarantees have remained the same. Specifications recently issued at Toronto, however, for a plant to have a capacity of 160 tons per day, include several important modifications, to be mentioned later.

When the fulfilment of contracts and specifications becomes the subject of litigation, weak points, if there be any, are likely to appear. The city officials in Atlanta and San Francisco have refused to accept the incinerators built for their cities, claiming that certain of the guarantees have not been fulfilled. The case at Atlanta is now before the court for its second trial, and testimony has been taken. The San Francisco case has not yet come to trial. It is pertinent to inquire into the relation between the specifications and guarantees, the failure of the plants to pass the tests, and general local conditions affecting the situation.

The plant at San Francisco was tested by the city officials as required by the specifications, for a period of 30 days, from September 4 to October 3, 1914. The results of the tests were reported by the city engineer with the recommendation that the plant be rejected for the reason that it did not fully meet the requirements of the specifications. The guarantees were essentially those quoted above from the Milwaukee specifications. The city engineer held that the plant failed to meet the requirements in the following particulars: (1) That no nuisance be created in its normal operation; (2) that no odors, obnoxious gases, smoke or dust escape from the building or the chimney; (3) that the temperature shall at no time fall below 1,250 deg. Fahr. (this guarantee, however, was fulfilled in that the average temperature was in excess of 1,500 deg. Fahr.); (4) that the residue from the furnaces be thoroughly burned, hard, and free from organic matter. In all other requirements the guarantees in the contractor's bid were fully met.

The grounds on which the city officials at Atlanta refused to accept the plant are very similar to those at San Francisco. It is claimed that nuisances are created during the operation of the plant; that dust, smoke and odors escape from the buildings; and that the residuum from the furnaces is not free from organic matter. It was also claimed by the city officials that the plant could not make steam at the guaranteed rate. This point hinged on whether or not the work done in the feed-water heater could be credited to the plant. The actual rate of evaporation under test fell either above or below the guaranteed rate, depending upon whether or not the evaporation was computed from hot or cold feed-water. The plant was tested on two occasions for periods of about one day each.

In both San Francisco and Atlanta the plants were operated by the contractor during a tuning-up period of about one year prior to their being tested. Defects in design and construction, which appeared during this time, were in each case remedied by the contractor, and it appears that so far as design and construction are concerned the two plants are up to the best work that has been done in this country and abroad.

Guarantees Unworkable

From this brief summary of the development and character of specifications now used for the construction of refuse incinerators, and from the statement made of the reasons for the rejection of plants of this type by two comparatively large cities, several deductions can be made. In the first place, the guarantees relating to the sanitary operation of the plant are so stated that their fulfilment is virtually impossible. It is a matter of great difficulty to handle mixed refuse so that absolutely no nuisance is created, and it is also practically impossible to prevent absolutely the escape of all obnoxious gases, smoke or dust from the chimney or building.

In other tests of incinerator operation under guarantees, engineers have interpreted these requirements somewhat more liberally. Plants which have fulfilled the intent of the guarantees have been accepted by city officials upon the recommendations of their engineers. In some instances, the recommendations have been qualified, as at Milwaukee, where it was stated that "a certain amount of dust and hot gas must be created, and it is, of course, not feasible to confine all of this inside the furnaces and ventilating ducts."

The requirements that the residuum from the furnaces shall be free from organic matter is also difficult to fulfil. In most instances where cities have accepted proposals in which this guarantee is made, there has also been required from the contractor a statement showing the method of computing the heat balance. Such heat balances include among the losses, an item for unburned carbon in the clinker and ash. Obviously this statement, presumably accepted by the city with the proposal, is in conflict with the requirement that the residual material be free from organic matter. It is evident, therefore, that in plants which have been accepted as having fulfilled this guaranty, the interpretation of the test has been liberal.

Toronto Specifications

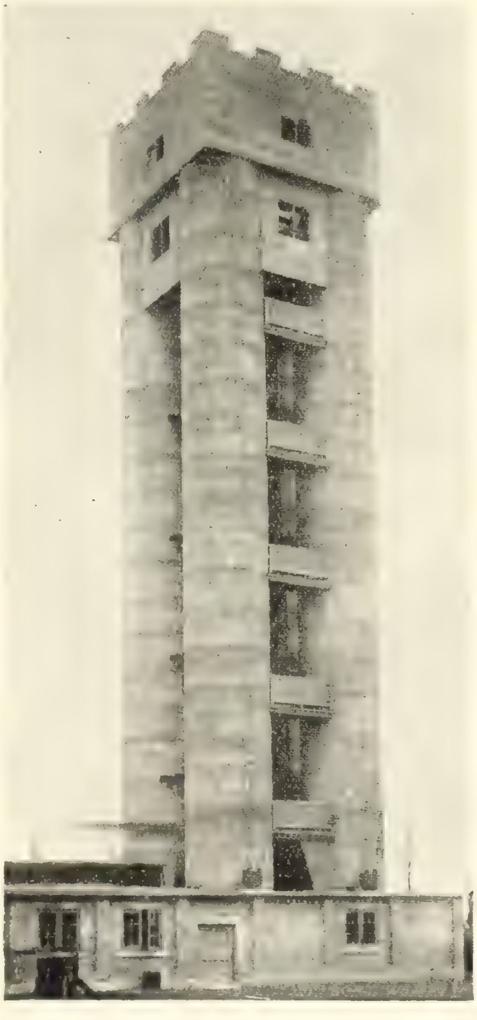
The Toronto specifications on these points include the following guarantees: (1) That no smoke shall at any time escape from the chimney of a degree of darkness or density greater than that determined by density 1 of Ringelmann's smoke chart; (2) that no dust shall be emitted from the top of the chimney; and (3) that the residuum from the furnaces shall not contain more than 1 per cent. of organic matter, exclusive of carbon.

It is quite possible to build plants which will fulfil these guarantees. Contractors who undertook to build plants under the stricter guarantees must have counted upon a liberal interpretation by city officials. It is probable that the definite statements of these guarantees were forced into the specifications by public opinion. The attempt of one side in a garbage controversy to satisfy the opposition may have led to promises incapable of fulfilment.

The bridge upon the Meuse at Bouvignes is a recent example of reinforced concrete work. Lying as it does in the region of the war, it is not unreasonable to suppose that, like other bridges in Belgium, it was exposed to more or less damage. The present bridge has a total length between abutments of 393 ft., made up of a mid-river span 110 ft. long and two end spans, each of about 140 ft. Reinforced concrete on the French Hennebique system is used here. Outside width of the bridge is 13 ft., including wagon way and two footways, and the former is paved with compressed asphalt laid directly on the reinforced concrete bridge-planking. This makes the roadway very elastic, and is found to be an excellent method. Some points about the building of the two piers in the river may be of interest. This work was carried out by means of caissons built of reinforced concrete and further stiffened by webs of the same. The details are from the columns of Ferro-Concrete, which cheerfully informs its readers that this bridge "is one of an interesting series which will be fully described and illustrated under the head of Ferro-Concrete at the Front, when the tide of war has once more been rolled back into Belgium on the advance towards the Rhine."

Reinforced Concrete Acid Towers

A group of reinforced concrete acid towers built for a large paper company at Erie, Pennsylvania, consists of four towers, 10 ft. by 99 ft., set in a square, 15 ft. centre to centre, with a common foundation slab and a housing at the top connecting all four towers. The foundation slab is 32 ft. square by 6 ft. thick, its horizontal reinforcement being engaged by the vertical rods of the tower reinforcement. The shells are 9 in. thick with ½ in. vertical and ⅝ in. rings of steel rods. The lowest tower section has 20 vertical bars in the circumference, but at the top these are reduced to 12 bars. The rings are spaced 5 in. apart in the lower section and 20 in. apart in the top. A floor over the towers carries a housing, 25 ft. 4 in. square by 7 ft. 6 in. high, over which is a water tank, 11 ft. square by 3 ft. high.



Reinforced concrete acid towers at Erie, Pa.

The proposed Maryland Street Bridge, Winnipeg.

New Bridges for Winnipeg

THE accompanying illustration is of the proposed Maryland Street Bridge, one of three bridges which it is proposed to build across the Assiniboine River. The estimated cost of the three structures is $459,355, divided as follows: Maryland Street Bridge, $141,680; Main Street Bridge, $191,276; Arlington Street Bridge, $126,379. These estimates include land damages, the removal of old bridges, and the construction of temporary bridges during the erection of the Main and Maryland Street structures. Mr. Paul Schioler is Bridge Engineer of the City of Winnipeg.

Temperature Changes in Mass Concrete

IN a paper contributed to the American Society of Civil Engineers, Mr. Charles H. Paul and Mr. A. B. Mayhew discuss the results thus far obtained of experiments made to determine the changes of temperature in the concrete of the Arrowrock Dam. Some of these experiments have been in progress for more than a year; the greater part of the results is still affected by the high temperature produced by chemical action while the cement is setting. Therefore this paper should be considered as one of preliminary character. Among the conclusions already reached are the following:—

(1) Large bodies of concrete deposited rapidly during a summer season develop a temperature of from 90 to 95 deg. F., within a period of about thirty days, and maintain nearly that temperature for several months.

(2) In the case of concrete 1 ft. from an exposed face, there is a daily variation in temperature of about 2 deg. F., when the daily variation in the temperature of the air is about 50 deg. F.

(3) In the case of concrete 2 ft. from an exposed face, there is a daily variation of less than 1 deg. when the daily variation in the temperature of the air is about 50 deg. F.

(4) In the case of concrete 3.5 ft. from an exposed face, no daily variation in temperature is apparent when the daily variation in the temperature of the air is about 50 deg. F.

(5) The seasoned variation in the temperature of concrete 3.5 ft. from an exposed face is about 32 deg. F. when the seasoned variation in the mean daily temperature of the air is about 75 deg. F.

(6) The experiments have not yet been carried far enough to show the seasonal variation at other distances from exposed faces, but it is probable that they become very much less as the distance from the face increases.

Oil Makes Concrete Waterproof

WHILE experimenting in an attempt to develop a non-absorbent, resilient and dustless road material, capable of withstanding the severe shearing and ravelling action of automobile traffic, Logan Waller Page, Director of the U. S. Office of Public Roads, discovered the waterproofing qualities of oil mixed concrete. Extensive laboratory and service tests have definitely established the value of this oil-mixed concrete for damp-proof construction, and a new bulletin, No. 230, has been issued by the U. S. Department of Agriculture. This bulletin discusses fully the preparation and use of oil mixed concrete. Briefly summarized, the conclusions to be drawn from them are that the admixture of certain mineral oils in small proportions, not to exceed 10 per cent. of the cement used, does not lessen the tensile strength of mortar; that the decrease in the compressive strength of mortar and concrete is not serious; that concrete mixed with oil takes much longer to set hard, perhaps twice as long, but that the increase in strength is nearly as rapid in the oil-mixed material as in the plain concrete.

The use of oil does not make the concrete impervious to heavy water pressure, but it does make it practically non-absorbent under low heads.

The value of oil-mixed concrete is said to be particularly great in the construction of basement floors and walls, watering troughs, cisterns, barns, silos and in all parts of concrete structures that are to be made damp-proof.

The oil should in no case exceed 10 per cent. of the weight of the cement and for the most part 5 per cent. is all that is necessary. Since a bag of cement weighs 94 pounds, 4.7 pounds of oil, or about 2½ quarts, should be added for each bag of cement used in the mixture.

The sand and cement should be first mixed with the proper amount of water into a stiff mortar, to which is added the correct amount of oil and the whole mass again thoroughly mixed until all traces of oil have disappeared. Particular care should be taken to insure that the oil is thoroughly incorporated in the mixture, and the time of mixing should be practically double that when the oil is not used.

The kind of oil is also important, and technical specifications are suggested in the bulletin, in order to prevent the use of certain oils which might tend to impair the strength of the mortar or the concrete.

For practical use the addition of oil will be found particularly useful in the construction of basement floors and walls. Many of these now in existence are continually damp and such a condition may be remedied by the application of an oil-mixed mortar coat to the old surface. A mortar composed of one part of cement and two parts sand, and containing 5 per cent. of oil, should be sufficiently non-absorbent for this purpose.

Watering troughs and cisterns made of oil-mixed concrete should also prove of considerable practical value in the conservation of water. In the construction of barns, where oil-mixed concrete is used, the interior will be noticeably drier than when ordinary concrete is used.

Owing to their durability, cleanliness and resistance to fire, concrete barns are becoming more and more popular, but they suffer from the disadvantage that during a long beating rain the side walls are inclined to absorb much moisture, which, ultimately, penetrates into the interior. The addition of oil to the extent of 5 per cent. of the weight of cement in concrete used in the side walls obviates this objection. Barn floors can also be constructed in the same way with advantage. A damp-proof floor is warmer because of the lack of evaporation from its surface, and it is also more sanitary than an ordinary concrete floor because of its non-absorbent character.

Attention is called, however, to the fact that extreme care in proportioning, mixing, and placing the concrete is absolutely necessary if the addition of any water-proofing agent is to be of any value. The process of oil with concrete has been covered by a public patent so that anyone is at liberty to use it.

Planning Formwork Ahead

Some years ago, writes a prominent contractor, when we simply sent the foreman a set of blueprints of the building and said, "Go ahead and build it," leaving him to work out his own form designs, column forms used to cost, for direct labor, as much as 18c. per sq. ft., and floor forms 12c. Now we spend much time in the office making plans, sometimes as many as 45 sheets of form details for a simple building. These designs may cost 0.2c. per sq. ft. of formwork. But now if the cost for labor for floor forms runs over 4c. per sq. ft. we want to know what is the matter; if it runs over 7c. for a column we usually make a row. We have come to the conclusion that a dollar spent intelligently in the draughting room usually saves ten on the work, and sometimes more.

Saanich municipality, Vancouver Island, is planning for big expenditures on water-works and paving projects. The work in view will call for $825,000, about one-half being set aside for the paving of streets and roadways.

Hydrated Lime and Ordinary Lime

By E. W. Lazell, Ph.D.[*]

EVERYONE is familiar with the fact that when quicklime is treated with water a violent action takes place, the lumps of lime break up, heat is generated, steam is given off and after the action is completed, a paste or putty remains —the ordinary lime putty used for mortar. The fact that quicklime has changed its form from dry lumps to a wet paste and that heat has been generated, prove that a chemical reaction has taken place; or that quicklime has combined chemically with water. It is a scientific fact that when any chemical change or reaction occurs exact amounts of the material are involved. In the chemical change which takes place when lime is quenched with water definite amounts of lime and water are involved; in slaking lime an exact amount of lime unites with an exact quantity of water, forming an exact amount of hydrated lime and it differs from the original quicklime, and if water is present to satisfy the calcium oxide (lime) then a dry powder will remain. This powder is hydrated lime and it differs from the original quicklime and from pulverized lime in its behaviour towards water. When water is added to hydrated lime no heat is generated nor does the material slake, thus indicating that water has no further chemical action on the hydrate.

What is Hydrated Lime?—Hydrated lime of commerce is the dry powder resulting from the treatment of lime with sufficient water to satisfy the chemical requirements of all the calcium oxide.

Necessity for Exact Proportions of Lime and Water.—In the foregoing, emphasis has been laid upon the fact that precise amounts of lime and water react chemically. In other words, 1 lb. of lime requires a certain definite amount of water to form a perfect hydrate. If too little water is used in quenching the lime in the process of manufacture, the lime will be burned in slaking, and free lime, or lime which is not combined with water, will be present in the hydrate, rendering the material unsound. Plaster made from such hydrated lime will later pop and pit, due to the gradual slaking of the free lime by the mortar made from such unsound hydrate generally works tough and non-plastic. The free, uncombined lime when present to any considerable extent, will dry out the mortar, rapidly decreasing its strength and causing it to crumble. Free lime in hydrated lime is a dangerous ingredient and one which will always give trouble.

If too much water is used in the preparation of hydrate the material will be damp and wet, rendering it difficult to handle.

Obsolete Methods of Manufacture.—In the past, three methods were used to produce hydrated lime:

(1) Small pieces of lime were placed in a basket and immersed in water for a few minutes, until slaking began, when they were withdrawn and placed in a heap in order to conserve the heat and prevent the escape of the vapour; the material swelled, cracked and became reduced to a dry powder.

(2) Lumps of lime were placed in a heap and wetted at intervals until the mass was equally moistened throughout. The slaking proceeded as in the first instance.

(3) Small pieces of lime were exposed to the air for a number of months, and the lime absorbed both water and carbon dioxide from the atmosphere, falling to a dry powder. The powder consisted of dry

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[*] Chemical Engineer, Portland, Ore.

sub-carbonate of lime containing about 10 per cent. to 11 per cent. of water.

These three methods of dry-slaking lime were crude, and unless the greatest care was exercised the resulting product contained particles of unslaked lime. The hydrate produced by these methods was generally short and possessed poor sand-carrying capacity; in fact, hydrated lime made by any of the above methods was suitable for use in agriculture only, and such hydrate should not be confounded with hydrated lime manufactured by modern methods.

Modern Methods of Manufacture.—The modern method of manufacturing hydrate depends upon the addition of a definite amount of water to a predetermined amount of lime. By no other method is it possible to produce a hydrate which will contain sufficient combined water to satisfy the demands of the calcium oxide (lime) present. It is of the utmost importance that all the calcium oxide be in combination with water, otherwise the hydrate will be unsound and unsuitable for building uses. That all the lime be satisfied with water will be insisted upon in any specification which may be drawn for hydrated lime to be used in the building trade, and it is vital for each manufacturer to recognize that the formation of hydrated lime involves a chemical change requiring the presence of exact amounts of lime and water. Since the process is chemical, it requires the same careful supervision as any other chemical process—such as the manufacture of Portland cement. The production and use of hydrated lime have been more retarded by the manufacture of only partly hydrated lime than from all other causes. Any method of manufacturing hydrated lime continually to produce a perfect product must be based upon weighing the lime used and measuring the amount of water added.

Advantages of Hydrated Lime from the Standpoint of the Manufacturer.—One of the great difficulties in connection with the manufacture of lime is the perishable quality of the product. Lump lime cannot be stored for any length of time without deteriorations, thus making the operation of the plant dependent upon the season and the whims of the weather. Kilns must be fired up, damped down, or put out, according to the season of the year and the condition of the weather. This unevenness of operation results in a high unit cost. Since hydrated lime can be stored in bins in a manner similar to cement, it is possible to make the operation of the plant more nearly continuous, thereby introducing economies in the manufacture and reducing the cost. The manufacture of hydrate also means a more extended market, as hydrated lime can be used for a number of purposes for which quicklime is not suitable.

Advantages to the Dealer.—Three principal advantages to the dealer are the ease in handling, less deterioration of the product, and the freedom from fire risk. These three facts alone should convince the dealer that it is more economical to handle hydrated lime.

Use of Hydrated Lime.—In general it may be stated that hydrated lime is suitable for any use in the building trade to which lump lime can be put, and it would appear that as soon as the material comes into general use, its advantages will be found to far outweigh any disadvantages. The use of hydrated lime does away with the necessity of slaking lime to a paste, thus saving the space required for the slaking bed as well as the labor of slaking. By the use of hydrate it is possible to proportion the mortar so as to have exact quantities present, since this form of lime comes into the market in convenient packages of known weight. This point is always appreciated by the architect and engineer, as it is a well-known fact when lump lime is used as much sand as possible is added, with the result that the mortar is lean and possesses little strength.

Mortar Made from Hydrate Stronger Than That Made from Slaked Lime.—In June, 1910, the writer presented the results obtained from an extended series of tests on mortars made from both hydrated lime and lump lime to the American Society for Testing Materials. One of the most important conclusions drawn from these investigations was that the mortar produced from hydrated lime was stronger than that produced from the corresponding lump lime slaked to a paste. This conclusion was to be expected, since it is possible to manufacture hydrated lime by mechanical means under good chemical control which is more thoroughly slaked than it is possible to slake lump lime on the job.

Practically all those who have investigated the strength of lime mortars have recommended the use of hydrated lime in place of lump lime. In Bulletin No. 30 of the U. S. Bureau of Standards the following statement is made:—"The proportion of impurities in hydrated lime is generally less than in the lime from which it is made. In building operations hydrated lime may be used for any purpose in place of lump lime, with precisely similar results. The consumer must pay the freight on a large amount of water, but the time and labor required for the slaking are eliminated and there is no danger of spoiling it either by burning or incomplete slaking. For all building purposes hydrated lime is to be preferred to lump lime. By its use the time and labor involved in slaking may be saved and the experience of the laborer is eliminated as a factor in the problem."

If the use of hydrated lime in the building trade is to be increased, this can be brought about only by the manufacturers of hydrate preparing and marketing only such material as is sound and contains no free lime. There is an increasing demand for hydrate for use in concrete to render the material more plastic and dense. Hydrated lime can be advantageously used in all cement plaster and stucco to make them work smoothly and give a more pleasing color. In all these uses the soundness of the hydrate is the paramount requirement. No one would think of using unsound cement—why, then, should they expect to use unsound hydrate?

The market for hydrated lime is present, and a concerted action on the part of the lime manufacturers to exercise the care necessary to make a thoroughly hydrated lime will result in a more extended use of the material. It is to be hoped that the manufacturers will direct their energies along this line.—Concrete-Cement Age.

The American Society of Civil Engineers have appointed a special committee to codify present practice on the bearing power of soils for foundations and to report upon the physical characteristics of soils in their relation to engineering structures. The committee have prepared three sets of questions asking (1) for results of tests for bearing value of soils; (2) for data as to the bearing value of soils from existing structures; and (3) for local practice as to the bearing value of soils. Answers to any or all of these series of questions are requested from every one having information concerning them.

The Five Orders of Architects

THE following extracts from a musty volume of the 18th century on the duty of the architect, contained in a recent issue of the London Builder, may appeal to the humorous side of some of our readers:

"As there be five Orders of Architecture—namely, the Tuscan, Dorick, Ionick, Corinthian, and Composite, of which all elegant structures be composed or ornamented—so likewise are there five orders or different kinds of architects, each differing from one another, yet all of them are paid or recompensed in like manner by those requiring their services, and the payment is at the rate of £5 per centum on the moneys expended on the erection of the structure devised by the architects.

"And the **First Order of Architects** is that called the Art Architect, who hath much conceit of his calling. He is oft-times dressed in curious fashion in a coat of velvet, and weareth a beauteous tie and a soft hat. His hair falleth over his forehead in curls and quaintly toucheth his collar. Those who employ him fear him, for he who crosseth his fancy he treateth as a felon or else sheddeth salt and bitter tears. His devices for buildings are oft-times exceeding quaint, and at times inconvenient to those who occupy the dwellings he deviseth. Yet is there thought and meaning abundant in all. He deviseth hearts upon doors and chimney-corners, the fires whereof oft-times smoke, yet their appearance is exceeding quaint and primitive. He quarrelleth with the decrees of the local surveyor, as no such an one existed in the time of the Heptarchy. The latches upon his doors one pulleth with a boot-lace, and he thinketh of a pigeon-cot and sundial even in the forecourt of a City office. Thy garden space he filleth with clipped yews and lily ponds, and the pegs for thy washing will he design to teach thy maidservant culture.

"Now, the **Second Order of Architects** is that called Practical, and none would know them from stockbrokers by outward seeming. Unlike the architect of the first order, he of the second order buyeth thy chimney-pieces ready-made and knoweth where thy wife wantyth the draining-board of a sink that her maid may place unwashed crockery thereon without hurt. He falleth in readily with thy wishes, saying this is the whole duty of one of his calling. Yet mayhap thou wilt discover the dwellings he deviseth are exceedingly commonplace and like to those raised by the builder without aid, and thou mayest find him more practical in word than in deed.

"The **Third Order of Architects** is the Competitive Architect, and the manner of his working is altogether different from that of the architect of the first and second order. For whereas these are chiefly concerned with the devising of dwellings, the Competitive Architect's brain is even like unto a seething caldron of mighty thoughts. He draweth out schemes for public buildings which are not straightway given unto him, but only if they have been matched against many others and adjudged better than they are. He burneth the mid-night lamp, and sweat rolls down his forehead even on to the paper whereon he worketh. He is balanced in the scales of hope and of fear, and his excitements are many. For, as Holy Writ hath it, many are called but few chosen, and oft-times the architect of the third order cannot discharge the reckoning of his washerwoman. Yet fixeth he his eyes on the stars and his mind is filled with great thought. When he succeeds he oft-times watcheth princes lay the corner-stone of his buildings while many applaud, and his name waxeth great in the land.

"Now, the **Fourth Order of Architects** men call Speculative and very different is their method. For the first three orders have no thought of the wherewithal from which payment must come, but wait in their chambers for the knock of the client. But those of the fourth order see a fair piece of land and show those who desire money how by building therein they can make more. Yea, balance sheets are the weapons wherewith they fight, and they will even tell one where money can be had at interest if more can be made by borrowing thereof. As other men, some among them are good and others bad, who lead the unwary into pitfalls and grow fat with the five per-centum on what has been expended. Yet the fourth order has its uses, nor may man condemn them without judgment.

"The **Fifth Order of Architects** is that called Official, and hath this difference from all others. For whereas the four orders we have mentioned live even upon five per centum or starve because it is lacking, the Official order is payed even by salary by public bodies who employ them continuously. So care sitteth not beside them, but neither does the hope of great reward brighten their years. And have they the bitterness spoken of in Holy Writ of serving masters manifold, who are appointed not because of their knowledge of Art, but simply by the pleasure of the ratepayer. And they get them grey hairs and troubles attending many committee meetings, nor are those who serve many gratefully treated. And, as among the other orders, some are cunning and fashion great devices, while others have not the skill of the artist.

"And the aforesaid we have mentioned are the five Orders of Architects who use the five Orders of Architecture that the children of man may have habitations, for, since mankind must increase and multiply, so must they have buildings that their bodies be not destroyed by the rigour of the elements."

FREQUENT inquiries are made for methods of cleaning stone. The use of acids is generally to be deprecated, because they tend to injure the texture of the stone. The following suggestions are given by an English contemporary: Equal parts of muriatic acid and water will remove spots of mortar on brick or stonework, but it is not the right material for cleaning stone that is begrimed from smoke and dirt. To accomplish this, apply to the surface, with a long-handled fibre brush, a strong solution of caustic solution of pearlash. Let it remain on for about fifteen minutes, then wash several times with clear water, using a stiff brush or broom for the purpose. If this is not effective enough, scrub the stone with a stiff fibre brush, using soft soap and concentrated lye and sand, allowing this to remain on the stone until nearly dry, then rinse with clear water, using a brush to remove cleaning material. Protect the hands with rubber gloves.

At a plant being constructed in Illinois, tailings from coal mines are to be substituted for clay in the manufacture of bricks. The process entails the combination of some coarse material, containing silica, with a binder of finely divided particles of silica, alumina, potassium, or sodium, in proper proportions. Bricks already made have withstood a temperature of 2,900 degrees F. and a pressure of 20,000 lbs. to the square inch, it is claimed.

Personal Mention

Mr. E. G. M. Cape, the Engineers' Club, and the Garth Company have each given a machine gun for the 60th Battalion which has just been raised in Montreal.

Mr. J. F. McNamara has succeeded Mr. W. E. Oakley as General Manager of the Bayonne Castings Company, Bayonne, N. J. The President of this firm, Mr. R. C. Stanley, advised us that the Company has been completely reorganized and that such changes have been made throughout the foundry and the office as will insure prompt and satisfactory services.

Mr. Ralph T. Coe, Manager of the Canadian Sirocco Company, Limited, Windsor, since the organization of the company, has resigned to enter the engineering service and sales field in New York State. Mr. Coe has been appointed District Manager for Warren, Webster & Company, and the American Blower Company, and will have offices at 519 Insurance Building, Rochester, and 19 Live Stock Exchange Building, Buffalo.

Mr. G. R. G. Conway, M. Can. Soc. C. E., has resigned as Chief Engineer of the British Columbia Electric Railway Company, Limited, and has been appointed Consulting Engineer to the company. In addition he intends to take up private practice in Toronto. Previous to his association with the British Columbia Railway, Mr. Conway was Consulting Engineer in connection with the construction of the Coquitlam dam for the Vancouver Power Company, and prior to his work in British Columbia he represented Mackenzie, Mann & Company, as Chief Engineer for the Monterey Railway, Light & Power Company and the Monterey Water Works & Drainage Company, at Monterey, Mex. Mr. Conway was educated at Hartley University College, Southampton, England. On leaving college he became assistant to the late Mr. James Mansergh, a former President of the Institution of Civil Engineers, and later Resident Engineer of the City of Aberdeen. Mr. Conway expects to open his Toronto office at the end of July.

Mr. G. R. G. Conway.

Mr. M. J. Butler, C.M.G., executive head of Armstrong, Whitworth of Canada, Limited, and ex-president of the Canadian Society of Civil Engineers, is to be appointed consulting engineer of the Montreal city water-works, which will include the construction of the filtration plant and the widening of the aqueduct. This work involves an enormous expenditure. Five million dollars has already been spent and the Controllers are asking for authority to spend an additional $3,500,000, made up as follows: $1,500,000 for installing the hydraulic power plant, pumps, etc.; $675,000 for strengthening the retaining walls; $560,000 for bridges over the open viaduct; $475,000 for additional improvements at the entrance of the open viaduct; $100,000 for water-gates; $87,864 for the supervision of the works; $35,000 for fences; $25,000 for ditches; $15,000 for culverts; and $25,000 for a wall at Bond Street.

Under the re-organization of the firm of M. Beatty & Sons, Limited, of Welland, Ont., which has just come into effect, Mr. H. L. Beatty becomes President and Mr. A. L Beatty Vice-President and General Manager. Mr. Harris T Dunbar, of Buffalo, becomes a member of the Board of Directors. Messrs. V. R. Browning, B. F. Miles and R. A Greene sever their connection with the company.

Mainly Constructional

East and West—From Coast to Coast

The Cedars Rapids Manufacturing and Power Company have under consideration adding 10,000 to 30,000 horse power to the capacity of the plant. Provision was made for this in the original plans.

The Aetna Explosives Company, who are building a plant in Montreal, have placed an order with the Turbine Equipment Company for two 750 k.w. non-condensing steam turbine-driven alternators.

A recent contract award of interest is that for an incinerator for the town of Transcona, Man. The successful tenderers were The Ideal Incinerator Company, Toronto, at a figure in the neighborhood of $20,000.

In future the Montreal Council will purchase rough granite stones and have them dressed in the city, the Stonecutters' Union having offered to cut straight curbs at 27 cents a foot and the corner stones at 30 cents a foot.

The Ric-wiL Underground Pipe Covering Company, with head office at Cleveland, O., has received an Ontario license authorizing it to carry on its business of manufacturing pipes, fittings and pipe coverings in that province. The license limits the amount of capital to be used in the province to $40,000.

Messrs. Viau & Venne, architects, Montreal, have awarded additional contracts in connection with the school and residence, which are to be erected on Fifteenth Ave., Lachine, Que., at a cost of $150,000. The building is to be 60 ft. by 243 ft. in dimensions, four storeys high, of concrete and brick construction.

Mr. Paul A. Schoellkopf, of the Hydraulic Power Company, is interesting himself in a scheme of permanent illumination of the Falls. Mr. Schoellkopf has just returned from the San Francisco Fair and states that he will use his influence to have the searchlight plant now used at the Fair removed to Niagara Falls, as soon as the Western exhibition is closed.

Excavation has already begun for the construction of the new plant of the Canadian Car and Foundry Company, at Kingsland, New Jersey. Work is to be pushed, and it is understood a building 1,350 by 327 ft. will be erected. The plant will be used for assembling and loading work in the fulfilment of the contract for shells which the company has with the Russian Government.

The new orphanage which is being erected on Decary Boulevard, Montreal, at a cost of $175,000, has reached the roofing stage. Good progress has been made on the building throughout. The architect is Mr. A. Piche, of Montreal, and the contractors are The Deakin Construction Company, of Montreal. The new building is of brick construction, with stone trimmings.

The foundation work has been started for the new theatre which the St. Denis Theatre Company, Limited, are going to erect on St. Denis Street, Montreal, at a cost of $300,000. The architects are Barott, Blackader & Webster, of Montreal, and the general contractors Messrs. Norcross Bros. Company, Limited, Montreal. The building is to be 205 feet by 110 feet in dimensions, of brick and steel construction.

Work is progressing rapidly on the two large blocks which are being erected on Portage Avenue, at Winnipeg. Day and night shifts are being worked in order that the buildings may be finished by next fall. Messrs. the Sutherland Construction Company have the contract for the Curry Block, while Messrs. Carter-Halls-Aldinger Limited, have the contract for the Paris Building, both of which will cost in the neighborhood of $250,000.

One of the largest industrial mergers of recent years in the West was recently consummated with the merging of the Western Foundry and Metal Company, Limited, and the Canadian Equipment and Supply Company, Limited, both of Calgary, and the International Supply Company, Limited, of Medicine Hat, into the Canadian Western Foundry and Supply Company, Limited, capitalized at $1,000,000, with head offices in Calgary.

In addition to building a transmission line to Quebec, made possible through the control of the Dorchester Electric Company, The Shawinigan Water and Power Company propose to enlarge the capacities of The Northern Aluminium Company and The Canada Carbide Company, with which the Shawinigan company is associated. The Aluminium company will install a plant for the making of rods, which are now made in the United States from the raw material manufactured and shipped by the company.

Operations have been commenced on the construction of a rural telephone system covering the district south of the city of Prince Albert. It is intended that ultimately this system shall cover a district of about two hundred square miles. The operations are being carried out by the South Prince Albert Rural Telephone Company, which was originally operating in this district. The contract for the work has been let to the North Saskatchewan Telephone Development and Construction Company. The line is purely a farmer's telephone system, and among the towns it will touch will be included Davis, Clouston, MacDowall and probably St. Louis.

Objection to the latest plans for constructing underground conduits, designed by the Montreal Electrical Commission, has been taken by some of the companies interested. Hitherto the cables for the police and fire alarm signals and for the light and power companies have been placed in the same conduits, but it is now declared that trouble is likely to result from this system, and it is asked that separate conduits be constructed. This will increase the cost, and the chairman of the Quebec Public Utilities Commission has agreed to adjourn consideration of the plans with a view to having the power companies confer with the members of the Electrical Commission.

An important by-law was introduced as the last meeting of the Winnipeg City Council. This by-law was in respect to the height of buildings and the approval of plans showing encroachments on public thoroughfares. It provides that no buildings shall be of greater height than one and three-quarters the width of the street on which it is to front, and no building shall in any case exceed 198 feet in height. Spires or towers may be erected above buildings, but they must not exceed three-fifths of the height of the building nor must they exceed 300 feet in any case. Final consideration of the proposed by-law will be given at the next meeting of the council.

The Grand Trunk Pacific drydock at Prince Rupert, B. C, (described in detail in a recent issue of the Contract Record). will be electrically-equipped. The power house, 104 x 148 feet, constructed of steel and concrete, contains two 1,000 k.w. turbine generators and a steam-driven air compressor of 1,500 cubic feet capacity. There are also six 400 h.p. water tube boilers supplied with automatic stokers of the chain grate type. A system of underground electrical conduits has been installed throughout the shipyard. On the dock three air compressors of 500 cubic feet each and twelve 24-in. centrifugal pumps are electrically driven. Each shop and the power house are equipped with a 15-ton electrical overhead crane.

One of the Canadian concerns which has benefited materially from war orders is Sheldon's Limited, of Galt, Ont., which owns and operates one of the finest grey iron foundries in the Dominion. Originally producers of heating, ventilating and drying plants, the company was one of the first to turn its attention to shell making, and owing to its aggressive management was among the first to secure orders from the British Government in connection with war supplies, and they are now working on very satisfactory contracts. According to a recent financial report, the net earnings of the company for the last four years have averaged about three and a half times the bond interest. Net earnings for the current year are expected to be more than double those of the previous four years.

Suit has been entered in the Supreme Court by Messrs. Palmer Bros. & Henning, contractors, against the Northern Construction Company, Limited, Messrs. Mackenzie & Mann, the Cowan Construction Company, Limited, the Canadian Northern Pacific Railway Company, the National Trust Company and the British Empire Trust Company, in which the plaintiffs claim the sum of $393,197, the amount they allege is due them as balance for work done in building a portion of the Canadian Northern Pacific Railroad. The total contracts secured by Palmer Bros. and Henning, as set out in the pleadings, amount to $2,228,719, of which all but $393,197 has been paid. The claim for constructing the line from Mile 40 to Mile 74.6 comes to $743,714. That for the line from Mile 27 west of Yellowhead Pass to Mile 35 is $463,714, which includes $76,750 for 1,228 feet of tunnel. The cost of the line from Mile 405 to Mile 424.50 is given at $1,008,276.

The proposed new water-works scheme at Victoria Park, as outlined by Works Commissioner Harris and recommended to the Toronto Board of Control, will cost about $6,000,000, and take four years to build. Some time ago the citizens passed favorably upon a by-law for water-works extensions, amounting to $6,667,000. Of this amount about one and a half millions has been sold, and the money, with the exception of perhaps $100,000, has been used up. The duplicate water-works scheme involves the laying of large mains in North Toronto, as well, for which debentures will shortly be issued. The pumping capacity of the city now is about 100,000,000 gallons a day, and the consumption from 50,000,000 to 60,000,000 gallons daily, but the Works Commissioner, Mr. Harris, points out that in four years this will be greatly increased. The new plant will have a daily pumping capacity of 65,000,000 gallons, and that will bring the total pumping capacity of the city up to 165,000,000 gallons daily.

The present status of the harbor development work at Toronto recalls the fact that the sum of $2,000,000 is being spent this year on the city's water-front from the Don to the Humber. Last year the sum of $1,400,000 was spent. The total cost of the undertaking is $24,000,000. The contracts awarded to date represent the expenditure of $11,000,-

000. The minimum amount to be filled in is 22,000,000 cubic yards and the maximum 32,000,000 cubic yards. The expenditure up to the present time represents $1,100,000 for work under water and $300,000 for work above water. One-fifth of the Ashbridge's Bay work has been filled in, while the Don diversion channel has been completed. The ships' channel is to be completed by the fall. Of the expenditure of $2,000,000 the sum of $1,750,000 goes into the work at the foot of Cherry Street and $250,000 at Sunnyside. The Chief Engineer of the Harbor Commission, Mr. E. L. Cousins, who is the author of the plans of this great undertaking, is now working for the Government on the City's transportation problem.

Large Oil Tanks at Montreal

On an ideal location, on the Tarte Pier of the Montreal Harbour Commissioners, the Asphalt and Supply Company, Limited, Board of Trade Building, Montreal, have erected two immense oil tanks for the purpose of storing oil used for road purposes. Each tank has a diameter of 95 feet by 30 feet, with a capacity of 37,500 barrels, or a total of 15,000 tons. In addition there is a barrelling tank of 1,000 barrels capacity, fed from the main tanks by means of underground pipes, and a fuel oil tank of 1,000 gallons capacity, which draws its supply from the barrelling tank. The fuel oil is utilized in a fuel oil boiler which generates steam for heating the oil prior to its being barrelled. The oil from the main tanks is forced into the barrelling tank by means of a pump. It is intended to add the necessary equipment for refining the oil into asphalt.

The oil is brought to Canada in oil tank steamers, one of which, the San Urbano, recently arrived in the port. This vessel discharged its cargo of 10,000 tons in ten hours. She is an oil-driven vessel, and is part of a fleet owned by the Eagle Oil Transport Company, of London, one of the many enterprises headed by Lord Cowdray. The oil is pumped from the oil-fields, situated eighty miles from Tuxpam, Mexico, to the shore, where it is stored in tanks ready to be pumped into the vessels.

The Asphalt and Supply Company's tanks are situated very near the harbour, and are filled direct from the steamers by means of heavy armoured hose, which is connected to the tanks of the steamer. The pumps of the latter are then set to work, the hose being shifted to the various tanks of the steamer as required.

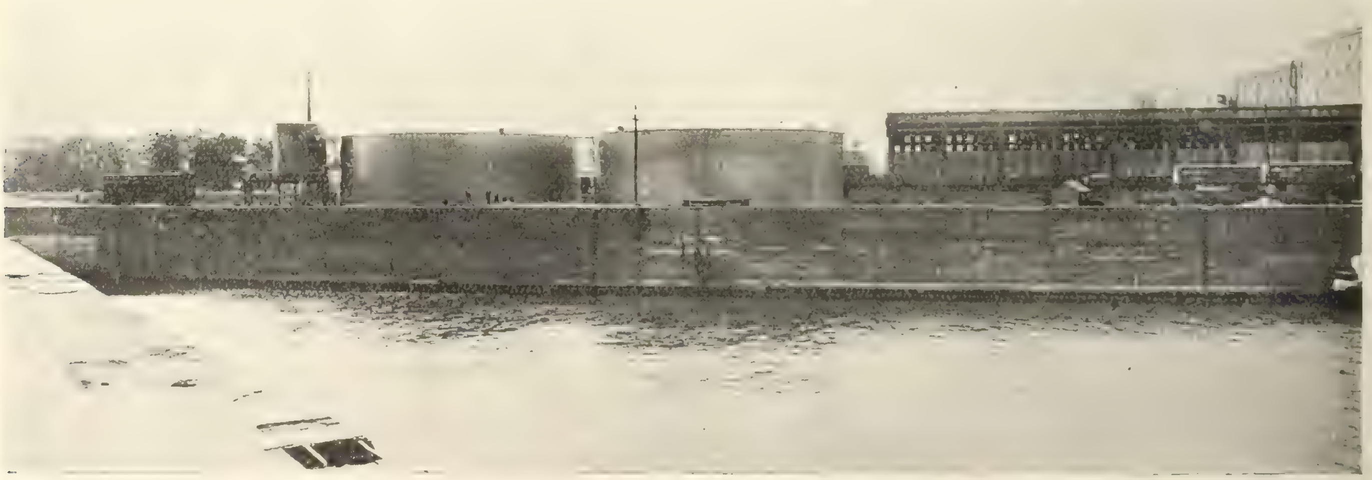
From M. Beatty & Sons, Limited, Welland, Ont., we have received a copy of an interesting, informative booklet issued in conjunction with the firm's general catalogue No. 21, which contains illustrations and condensed descriptions of Beatty hoists and handling, dredging, and excavating equipment. The firm's products are too well known to require special commendation at our hands. Only a small part of the various equipment is shown, the purpose of the book being to give the contractor concise information calculated to be suggestive to him. The firm's general catalogue, which will be sent on request, gives a detailed description of Beatty hoists, with tables showing sizes, capacities, and weights.

The Republic of Cuba has established a permanent exhibition to which foreign countries have been invited to contribute. Articles taking up large space are excluded. In addition to the products of various countries, arrangements have been made for placing on show lists of trade marks and patent agents, steamship lines, prices, books and pamphlets on commercial and industrial matters, and so forth.

The General Car and Machinery Works, Limited, of Montmagny, P. Q., makers of road machinery, have opened an office at 317 St. James Street, Montreal, under the managership of Mr. J. H. Langis.

In all buildings where numbers of machines are working simultaneously, reinforced concrete offers manifest advantages, because its exceptional rigidity and solidity enable the construction to absorb vibration in a most effective manner. Apart from any question of comfort to workpeople, and of freedom from damage to the structure itself as a result of vibration, the machinery runs better and lasts longer than that in a building subject to vibration. It is stated by Mr. Leonard C. Wason, of Boston, that cotton manufacturers in the United States have found that looms can be run fifteen per cent. faster on concrete floors than on wooden floors subject to vibration; and that a considerable saving of power can be effected in consequence of the rigidity of the construction.

In a paper read to the Royal Institute of British Architects, Mr. Segar Owen says that the ideal factory for reinforced concrete is one made up of units of space and loads as regards floor area and machinery, each floor being set out without much possibility of change. Fire-resisting, temperate, vermin-proof, these buildings form excellent stores, and where carriage of large and heavy girders to the works site is a big item of expenditure a considerable saving can be made by this form of construction.



Storage tanks of the Asphalt and Supply Company, Limited, Tarte Pier, Montreal.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Belleville, Ont.

The laying of pavement on Pinnacle Street, George Street and Victoria Avenue is being considered by the City Council. Clerk, J. Wilfred Holmes.

Collingwood, Ont.

The Town Council are about to issue debentures to the amount of $15,000 for improvements to the Water Works. Clerk, J. H. Duncan.

Cornwall, Ont.

The Town Council contemplate laying granolithic sidewalks on Ninth and First Streets. Engineer, W. H. Magwood.

Guelph, Ont.

The City Council contemplate laying macadam pavement and concrete sidewalks on several streets. Clerk, T. J. Moore.

Work will commence at once on laying 5,500 feet of conduit pipe under the supervision of the Water Commissioners.

Halifax, N. S.

City Engineer F. W. W. Doane has recommended the laying of concrete sidewalks on Morris Street and Victoria Road.

Hull, Que.

The City Council are receiving quotations on a quantity of hydrants, nozzles and valves. Clerk, H. Boulay.

Leamington, Ont.

Plans are being prepared for reinfroced concrete pavement to be laid on Erie Street, and tenders will be called shortly. Engineer, J. J. Newman, Ouellette Avenue, Windsor. Approximate quantity, 7,600 square yards.

Lennoxville, Que.

A by-law has been passed authorizing the purchase of the waterworks, and the expenditure of $14,000 on repairs and extensions. Clerk, W. W. Baker.

London, Ont.

The City Council are about to call for tenders on the construction of a trunk sewer on Waterloo Street. Engineer, H. A. Brazier.

Simcoe, Ont.

The Town Council have referred to the Board of Works a proposal for laying concrete pavement on Colborne St. Clerk, W. C. McCall.

St. Catherines, Ont.

The City Council are considering the laying of pavement on a number of streets. Engineer, W. P. Near.

St. John, N. B.

The City Council are about to lay a quantity of watermain by day labor under supervision of the Engineer, W. Murdock. Commissioner Wigmore is receiving prices on waterpipe, from 4-inch to 24-inch diameter.

Stratford, Ont.

The City Council are considering the construction of sewers on Front, Mile and High Streets and Railway Avenue. Engineer, A. B. Manson.

Welland, Ont.

The Town Council have decided to lay a sewer on Seeley Street. Engineer, D. J. Black.

CONTRACTS AWARDED

Bathurst, N. B.

The City Council have let the following contracts for the construction of waterworks and sewerage systems:—dam, power house, water and sewage installation, A. R. C. Clarke & Son, Water Street, St. John, at $110,788; standpipe, Chicago Bridge & Iron Works, Washington Heights Station, Chicago, at $13,860.

Fort Erie, Ont.

The Municipal Council have let a contract for the construction of a mile of macadam and about 1,000 feet of concrete roadway to W. H. Johnston, Fort Erie. Approximate cost, $10,000.

Guelph, Ont.

The City Council have let the contract for the construction of a reservoir to Hollingsworth & Brennan, 15 South Street, Hamilton, at $8,618. Reinforcing metal, valves and pipes will be supplied by the City.

London, Ont.

The City Council have let the following contracts for sewer construction:—The Fielder Construction Company, 190 Tecumseth Street, approximately $2,500; Webster Construction Company, Bank of Toronto Chambers, $1,200; J. McMurphy, $900.

Melancthon Township, Ont.

The Township Council have let a contract for drain work to F. Calligan, Dundalk, Ont., at $3,500.

Morris Township, Ont.

The Township Council have let the contract for the construction of the Bosman Drain to Felix Curtin, care of John Brooks, Bluevale. A quantity of clay tile will be purchased by the contractor.

Moulton Township, Ont.

The contract for drain work has been awarded by the Township Council to J. Ewing and J. Waddell, Dunnville, Ont.

New Glasgow, N. S.

A contract for laying concrete sidewalks for the City Council has been let to J. Johnson, at 13c. per foot.

Ottawa, Ont.

The City Council have let the contract for laying asphalt pavement on Anglesea Square S. to the Ottawa Construction Company, Central Chambers. Estimated cost, $5,000.

Toronto, Ont.

The following contracts for sewer construction have been awarded by the Board of Control:—West Toronto Sewer, Jennings & Ross, 79 Spadina Avenue, at $32,000; storm overflow sewer, Grant Contracting Company, 50 Front Street E.; Edna Avenue, Commissioner of Works, City Hall; Cloverdale Avenue, Tortorelli & Company, 80 Woodycrest Avenue.

A contract for laying a quantity of asphalt paving has been let by the Board of Control to the Commissioner of Works, R. C. Harris, City Hall.

Railroads, Bridges and Wharves

Chatham, N. B.

Plans of a dam are being prepared by R. S. & W. S. Lea, New Birks Building, Montreal, for the City Council. Tenders will be called shortly. Estimated cost, $20,000.

Haldimand County, Ont.

The County Council will call for tenders shortly on the construction of a number of concrete bridges.

Kennebec Township, Ont.

. Plans have been drawn for a steel bridge to be built over Big Cross Lake by the Provincial Government and Frontenac County. Approximate length, 400 feet. Stone approaches.

Swan River, Man.

A by-law has been passed authorizing a debenture issue of $22,000 for the construction of a number of bridges. Municipal Secretary, Joseph Armstrong.

Toronto, Ont.

The Chairman of the Board of Control will receive tenders until August 3rd on the supply of tie rods and plates and for special track work for the Lansdowne Avenue street railway extension. Commissioner of Works, R. C. Harris, City Hall.

CONTRACTS AWARDED

Dufferin County, Ont.

The County Council have let contracts for the construction of two reinforced concrete bridges to W. D. Ballery, Bellwood P. O., and to John Coutts.

Hebertville, Que.

The contract for steel work for the bridge over Lake St. John has been let by the Municipality to the Dominion Bridge Çompany, Limited, Lachine, Que.

Madawaska County, N. B.

The Department of Public Works, Fredericton, have let the contract for the construction of a concrete embankment and culvert at Four Mile Brook to C. A. Beck, Woodstock, at $4,000.

Nova Scotia Province

The Department of Railways and Canals, Ottawa, have awarded the contract for the construction of reinforced concrete culverts to G. W. Jewett, Sheffield, N. S., at $52,000.

Quebec Province

The general contract for paving the Yule Bridge between the Municipalities of Chambly Canton and Richelieu has been let to G. Pepin, Chambly Basin, Quebec. Approximate cost, $6,200.

Shawinigan Falls, Que.

The Municipal Council have let the general contract for the construction of a bridge over the Shawinigan River to B. J. Trepanier, 24 Niverville Street, Three Rivers. Sub-contract will be let for steel superstructure. The approximate cost of bridge, $15,000.

St. Boniface, Man.

The contract for the erection of Provencher Avenue Bridge has been transferred to the Dominion Bridge Company, Limited, Canada Building, Winnipeg. Scherzer Bascule design, with underneath counterweight. Approximate cost, $264,707.

St. Philemon, Que.

The Municipality have let the subcontract for steel work in connection with the bridge in course of erection to the Phoenix Bridge & Iron Works, Limited, 83 Colborne Street, Montreal.

St. Vincent Township, Ont.

The Township Council have let the contract for the construction of abutments for a bridge on the 8th concession to W. McColeman, Meaford, and the contract for the superstructure to the Hamilton Bridge Company, Bay Street North, Hamilton.

Vancouver, B. C.

The City Council have let the contract for repairs to the Connaught Bridge to W. Greenlees, 407 Cordova Street West at $7,491. Previous contracts cancelled.

Public Buildings, Churches and Schools

Bothwell, Ont.

Tenders on the erection of a Town Hall will be received until August 4th by the Town Clerk, W. H. Bradley. Plans and specifications at offices of the Architect, W. G. Murray, Dominion Savings Building, London, Ont., and of the Mayor, W. B. Bemish. Approximate cost, $8,500.

Brantford, Ont.

The City Council have passed a by-law providing for a $12,000 debenture issue for school purposes. Clerk, H. F. Conant.

Burford, Ont.

Tenders on the installation of fittings at the Post Office will be received until 4 p.m., August 4th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications with G. W. Hall, Clerk of Works, Burford, T. A. Hastings, Clerk of Works, Postal Station F., Toronto, and at the Department, Ottawa. Specifications only at office of MacLean Daily Reparts, 25 Charlotte Street, Toronto.

Cardston, Alta.

Tenders on the construction of a twelve-roomed school are being received by M. A. Coombs, Chairman of the School Board. Plans and specifications with the Secretary, J. E. Harris. Estimated cost, $40,000.

Colborne, Ont.

The Town Council have passed a bylaw providing for the erection of a fire hall and police cells. Clerk, H. S. Keyes.

Coteau Station, Que.

The Roman Catholic School Board are considering the installation of a heating system in the Academy School. Suggestions, prices and other information with regard to this work are being received by the Secretary, G. E. Andre.

Port Colborne, Ont.

Tenders on the erection of an eight-roomed school will be received until 5 p.m., July 30th, by C. N. Alair, Secretary to the Board of Education, or the Architect, C. M. Borter, 102 Main Street, Niagara Falls.

Prince George, B. C.

J. E. Griffith, Deputy Minister of Publyis Works, Victoria, will receive tenders until noon, August 6th, for the construction of a two-roomed school. Plans and specifications at office of T. W. Herne, Government Agent, Prince George, and at the Department, Victoria.

Quebec, Que.

Plans for a College estimated to cost $30,000, are being prepared for the School Commissioners of Quebec by Tanguay & Lebon, 20 A'Oiguillon St. Tenders will be called shortly. Stone, brick and steel construction, concrete and stone foundation, metal roofing.

St. John, N. B.

Plans of a school are being prepared for the Separate School Board by C. W. West, Clarendon Street.

St. Johns, Que.

The general contract for alterations and additions to the academy has been let by the School Commissioners to Charles H. Mailhiot, Iberville, Que. Stone and brick construction.

Toronto, Ont.

Work has been started on the erection of a dispensary at the Church of England Deaconess Home, Gerrard and Pembroke Streets. The contract for masonry has been let to E. H. Thomas, 75 Hilton Avenue, and for carpentry to R. G. Kirby, 539 Yonge Street. Brick construction, shingle, felt and gravel roofing. Approximate cost, $5,000.

Transcona, Man.

A by-law for the construction of a school has been defeated and the matter now stands in abeyance.

Windsor, Ont.

The congregation of the Baptist Coloured Church will be in the market shortly for electrical fixtures. Pastor, Rev. Charles Wills.

Winnipeg, Man.

Tenders for the supply of about 800 school desks will be received until August 5th by the Public School Board. Specifications at office of the Commissioner of Supplies.

CONTRACTS AWARDED

Barrie, Ont.

The contract for the erection of a public library on Collier Street has been let by the Town Council to the Ball Planing Mill, 74 Bayfield Street. Approximate cost, $15,000. Cut stone, terra cotta and brick construction.

Brantford, Ont.

The Board of Education have let the contract for heating and ventilation at the Central School to the general contractors, R. H. Ballantyne, 3-7 King St., at $8,000.

Greenfield Park, Que.

The general contract for the erection of a school for the Protestant School Board has been let to Murray & Dempsie, Greenfield Park Avenue.

Lachine, Que.

In connection with the school and residence to be erected on Fifteenth Avenue for the Catholic School Commissioners, the contract for excavation, brick and stone work has been let to F. C. Brunet, 13 Piche Street, and for roofing, heating, plumbing and electrical work to J. O. Desforges, 443 St. Joseph Street. Approximate cost of work, $150,000.

London, Ont.

The Board of Education have let the following contract in connection with the school on Riverview Street:—carpentry, R. Willis, 5 George Street; heating and plumbing, Noble & Rich, Queen Street; painting, Galley & Son, Dundas Street; plastering, John Fern; galvanized iron work, Steveley & Son, Richmond Street.

Lundar, Man.

Work has been commenced on the erection of a school, estimated to cost $10,000. The carpentry, steel, roofing, plastering and painting contracts have been let to Johnson & Sykes, and the heating contract to MacDonald Bros., 276 Burrows Avenue, Winnipeg.

Marmora, Ont.

The general contract for the erection of a public school has been let to David Simmons, Marmora, and work has been commenced. Approximate cost, $10,000.

Montreal, Que.

The general contract for the erection of a school on Fairmont Avenue E. for the Commissioners of St. Viateur, 62 St. Joseph Boulevard, has been let to A. & D. Boileau, 1485a St. Andre Street. Approximate cost, $5,000.

The contract for marble work at the orphanage in course of erection on Decary Boulevard has been let to the Mariotti Marble Company, Provincial Lane, Montreal.

The contract for alterations to the Protestant House of Refuge on Dorchester Street West has been awarded to W. M. Irving, 26a Stanley Street. Estimated cost, $15,000. Work consists principally of interior decoration and renovation.

Outlook, Sask.

The general contract for the erection of a college for the Norwegian Lutheran College Association has been awarded to Poole & Emery, Limited, Smith Street and Twelfth Avenue, Regina, and the plumbing contract to the Regina Plumbing & Heating Company, Limited, Engineers Building, Regina.

Port Arthur, Ont.

The contract for plastering at the addition to St. Joseph Hospital on Algoma Street has been let to M. G. Britton, 4 Meek Street.

A church is being built at Dufferin and Banning Streets for the Italian congregation by I. L. McRae, 488 Red River Road. The work has been stopped temporarily on account of lack of funds.

Sarnia, Ont.

The Sarnia Golf Club have let the contract for the erection of a club house on Christina Street N. to A. McColman, 120 Nutton Street. Contractor will do carpentry, roofing, plastering and painting. Approximate cost, $10,000.

Springhill, N. S.

The general contract for the hall which is being erected for the Knights of Pythias has been awarded to the Springhill Manufacturing Company, the masonry and plastering contract to Fage & Lusby, the plumbing and heating contract to J. C. Weatherly, Springhill, the contract for painting to E. A. Potter & Son, Church Street, and for electric wiring to the Edison Electric Light Company, Main Street.

The Pas, Man.

The general contract for the construction of a school for the School Board has been awarded to Pigott & Healey, Battleford, Sask., and the contract for plumbing and heating to A. T. Englebretson, The Pas. Estimated cost, $43,000.

Toronto, Ont.

The contract for brick and masonry work at the school in course of erection on Baby Point Road has been let to Albert Webb, 13 Shirley Street, Toronto, at $7,900 and for carpentry to T. P. Wright, Baby Point Crescent, West Toronto, at $5,435.

Work has been resumed on the erection of the First Church of Christian Science at Lowther Avenue and St. George Street. The cut stone contract hace been awarded to Nicholson, Curtis & Vick, 1117 Yonge Street.

In connection with the addition to St. John's Church, Kingston Road and Woodbine Avenue, the contract for tinsmithing has been let to F. Toseland, 304 Kingston Road, and for plumbing to Stratton & Cook, 314 Lee Avenue.

Truro, N. S.

The Town Council have let the general contract for the erection of a central fire station to W. K. McDonald, Bible Hill, at $8,495, and the heating and plumbing contract to W. J. Christie, Prince Street.

Westboro, Ont.

The contract for roofing at the school in course of erection on Euclid Street has been let to W. G. Adamson, 126 Sparks Street, Ottawa, the plastering contract to Murphy & Morrow, 139 Waverley Street, Ottawa, the contract for heating to J. E. Sheppard, 261 Albert Street, Ottawa, and for electrical work to J. E. Lewis, Westboro.

Winnipeg, Man.

The contract for the erection of an addition to the Polson Avenue School has been let by the School Board to Worswick Bros., 123 Hart Avenue, Elmwood, at $39,974.

The contract for the completion of the First Church of Christ on River Avenue has been let to the Fort Garry Construction Company, Limited, Ross and Arlington Streets, at $38,285.

Business Buildings and Industrial Plants

Ayer's Cliff, Que.

A. G. Gough is building a general store. Architect, Charles Robinson, Ayer's Cliff.

Barrie, Ont.

The erection of a store at an estimated cost of $8,000 is contemplated by H. D. Minnikin, 227 Elizabeth Street.

Hamilton, Ont.

George Webb, 136 Stinson Street, has commenced the erection of a store and apartments at 22 Wentworth Street, estimated to cost $5,000. Tenders on the smaller trades are now being received. Brick construction.

Plans have been drawn for a store and residence to be built on King Street E. by George E. Mills, King Street. Brick construction, stone foundation, felt and gravel roofing. Estimated cost, $4,000.

London, Ont.

In connection with the stores being built at 346 Dundas Street for F. B. Fetterley and M. Aylesworth, the following contracts have been let:—carpentry, S. Willis, 765 Talbot Street; plumbing, Noble & Rich, Queens Avenue; heating and galvanized iron work, Stevely & Son, Richmond Street; plastering, John Senn, William Street; painting and glazing, W. Clark.

Montreal, Que.

Work will start shortly on the erection of a shop and storeroom at Baldwin Park for the City Council. The City will buy material and work will be done by day labor. Brick superstructure, fireproof construction, concrete foundation and floors. Approximate cost, $18,500.

Tenders will be received until August 5th for the erection of a picture theatre on Park Avenue for the Independent Amusement Company, Limited. Plans and specifications with the Architect, D. J. Crighton, Jacobs Building, St. Catherine Street. Estimated cost, $100,000.

Ottawa, Ont.

The painting at the theatre erected on Queen Street for B. Stapleton will be done by day labor. Contract for seating not let.

Ouebec, Que.

G. J. Belanger, 1 Second Street, Limoilou, has commenced the erection of a store and residence, estimated to cost $6,000. Work by day labor. Sub-contracts will be let for roofing, plastering, painting, heating, plumbing and electrical work.

Sydney, N. S.

Tenders will be called shortly on the erection of a store for Wrights Limited, 234 Charlotte Street. Architect, F. W. Spencer. Brick and reinforced concrete construction, concrete foundation, felt and gravel roofing.

Thorold, Ont.

Plans are in course of preparation for alterations to the Grand Trunk Railway Station. Tenders will probably be called for shortly. Superintendent, J. H. Gordon, Hamilton.

Toronto, Ont.

Work has been started on the erection of an addition to the factory of the Canada Metal Company, Fraser Avenue. The contract for masonry has been let to Thomson Bros., Rusholme Road, and for carpentry to R. G. Kirby, 539 Yonge Street. Approximate cost, $15,000.

Plans have been completed for stables to be erected at Ramsden Park for the Board of Control. Approximate cost, $36,000. Commissioner of Works, R. C. Harris, City Hall.

Plans have been drawn for two stores and apartments to be erected at 1259 St. Clair Avenue W. by M. Helfaud, 1378 St. Clair Avenue W. Brick construction, felt and gravel roofing. Estimated cost, $4,000.

George Edwards, 18 Victoria Street, has had plans drawn for a store and workroom to be built at 315 College Street, at an approximate cost of $3,500. Brick construction, felt and gravel roofing.

Winnipeg, Man.

In connection with the store and office building in course of erection on Portage Avenue for D. S. Curry, the contract for installation of elevators will be let by the Architects, J. D. Atchison & Company, 913 Boyd Building.

Zurich, Ont.

William Johnston is constructing cement foundations and making other improvements to his farm buildings.

CONTRACTS AWARDED

Blenheim, Ont.

The general contract for the erection of a hydro electric light station has been awarded to J. J. Cookson & Son. Pressed brick construction.

Cote St. Paul, Que.

In connection with the premises in course of erection at Church and Handley Streets for Molson's Bank, the contract for masonry and carpentry has been let to the general contractors, Anglins Limited, 65 Victoria Street, Montreal, and for metal windows to the Metal Shingle & Siding Company, Limited, 91½ Delorimier Avenue, Montreal. Painting not yet awarded.

Drummondville, Que.

The general contract for the erection of a powder works for the Aetna Chemical Company, Limited, 120 St. James Street, Montreal, has been awarded to Westinghouse, Church, Kerr & Company, 137 McGill Street, Montreal. Resident Engineer, Charles Henderson, Drummondville.

Fort William, Ont.

In connection with the stores being built on Victoria Street for J. C. Murray, the heating contract has been let to the Varlow Brass Foundries Limited, Syndicate Avenue S., the contract for plumbing to the Superior Heating & Plumbing Company, Leith Street, and for electrical work to the Western Electric Company, Victoria Avenue.

London, Ont.

The brickwork contract in connection with the stores being built on Dundas Street E. for J. M. Moore, 478 Waterloo Street, has been let to the general contractor, N. Southern, Renwick Avenue, the contract for ironwork to the Dennis Iron Works Company, 22 Dundas Street, and for lumber, doors, etc., to G. H. Belton, Rectory Street.

W. G. Meakins & Sons, Hamilton, have

let the general contract for repairs to the knitting mills on Dundas Street to L. J. Beatty, 175 Emerald Street, Hamilton, and the contract for steel work to Woodhall & Sinclair.

Montreal, Que.

The following contracts have been awarded in connection with the store and apartments erected at 128 Mansfield Street for Oscar Dufresne:—roofing, M. Chouinard, 751 Adam Street, Maisonneuve; painting, Penadre Bourdon, 160 Fifth Avenue, Maisonneuve; refrigeration plant, Canadian Ice Machinery Company, 82 Chestnut Street, Toronto; cork insulation and refrigeration doors, Canadian H. W. Johns-Manville Company, Limited, 450 St. James Street, Montreal; plastering, J. Lefebure, 150 Ontario St. E.

Ottawa, Ont.

The carpentry contract in connection with the stores and apartments in course of erection on Bank Street for Donald Fraser, 82 O'Connor Street, has been let to W. Thompson, 1093½ Wellington Street.

Quebec, Que.

The contract for heating in connection with a store in course of erection on St Joseph Street has been let to S. Domcarlos, Abraham Hill, and for electric work to Goulet & Belanger, Crown St.

In connection with the Union Station in course of erection at St. Paul and Henderson Streets, the contract for limestone has been let to the Chateauvert Quarry Company, 25 St. Paul Street, and for supply of brick to the Citadel Brick Company, 42 Dalhousie Street.

Sarnia, Ont.

The following contracts have been let for the erection of a store on Christina Street W. for Hubert Yard, 161½ Lochiel Street:—general and carpentry, D. Giffin, 289 Maxwell Street; masonry, E. McDonald; plumbing, F. Goodwin Company, 215 Christina Street W. Approximate cost, $4,000.

Springhill, N.S.

The contract for masonry and plastering at the branch erected for the Canadian Bank of Commerce has been let to Fage & Lusby, the plumbing and heating contract to J. C. Weatherby, the contract for painting to E. A. Potter & Son, Church Street, and for wiring to the Edison Electric Light Company, Main Street.

St. Catharines, Ont.

Newman Bros., 75 St. Paul Street, have been awarded contracts for the erection of an addition to the japanning building of the McKinnon Dash & Hardware Company, and of a storage building for the McKinnon Chain Company. Architects, Krumm & Lynar, Queen St.

St. John, N. B.

The contract for galvanized iron work at the building in course of erection on Prince William Street for the James Kennedy Estate has been let to James McDade, Mill Street.

Toronto, Ont.

In connection with the lodge, stable and garage in course of erection at Government House, Douglas Drive, the contract for paving has been let to Witchall & Sons, 156 St. Helens Avenue, and the carpentry contract to J. C. Scott Company, 108 River Street.

In connection with the pair of residences being built at 42-44 Fulton Avenue by J. F. Glennie, 10. Fulton Avenue, the contract for plumbing has been let to R. J. Ritchie, 851 Logan Avenue, and for plastering to B. Davidson, 1073 Davenport Road.

Westmount, Que.

The steel work contract for the stores and residences in course of erection on Sherbrooke Street for G. A. Dion, 4120 St. Catherine Street, has been let to the Dominion Bridge Company, Limited, Lachine, Montreal.

Residences

Agincourt, Ont.

A. Doherty, Ellesmere, Ont., is erecting a residence, estimated to cost $5,000, Brick construction, cement foundation, shingle roofing.

Ailsa Craig, Ont.

Thomas Risdale, Mill Street, is building a frame and roughcast residence, estimated to cost $3,200.

Work on the erection of a residence has been commenced by W. Clatworthy, Main Street. Frame and white brick construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Brantford, Ont.

Contracts will be let for heating, plumbing and electrical work in connection with the residence in course of erection at 161 Dufferin Avenue for E. B. Duncan, 104 William Street.

Erin, Ont.

Colwill, Boothe & Company, Union Bank Building, Guelph, are preparing plans of a residence to be erected for J. Coke. Stone and brick construction. Estimated cost, $4,500.

Guelph, Ont.

Colwill Boothe & Company, Union Bank Building, are preparing plans of a bungalow for James Simpson, Wellington Place. Tenders will be called shortly. Stone and brick construction. Estimated cost, $6,000.

Halifax, N. S.

Work has been started on the erection of a residence on Jubilee Street by the Eastern Investment Corporation, Cragg Building. Frame construction, concrete foundation, shingle roofing. Estimated cost, $5,000.

The City Building and Land Company, 166 Hollis Street, have commenced the construction of a frame residence estimated to cost $4,000.

Work has been started on the erection of two residences on Oxford Street for the Eastern Investment Corporation, Cragg Building. Frame construction, shingle roofing. Approximate cost, $7,000 each.

James Hillis, c/o Hillis & Son, Hollis Street, has commenced the erection of a number of flats on Coburg Road. Estimated to cost $8,000. Frame construction, concrete foundation, shingle roofing.

Hull, Que.

The residence in course of erection for Edward Pelletier, Montcalm Street, is being built by day labor.

Mitchell, Ont.

The erection of a residence on Main Street E. is being considered by John Lehman, Logan Road.

Montreal, Que.

S. A. Brochu, 294 St. Catherine Street E., is building six flats on Iberville Street, estimated to cost $4,000.

A block of nine flats is being built on Chateaubriand Street by Pascal Latreille, 2597 Hubert Street. Approximate cost, $5,000.

Ottawa, Ont.

James Brownlee, 11 Clemow Avenue, has commenced the erection of a residence on Allan Street. Contracts will probably be let for heating, plumbing and electrical work. Estimated cost, $4,500.

G. A. Clark, 106 Kent Street, has prepared plans for a residence to be erected on McDonald Street at an estimated cost of $4,000. Brick veneer construction, stone foundation, shingle roofing.

Plans of a residence to be built on First Avenue have been drawn by E. F. Day, 240 First Avenue. Brick veneer construction ,stone foundation, shingle roofing. Approximate cost, $5,500.

Port Rowan, Ont.

W. P. Ferrie is preparing plans for a residence estimated to cost $3,000. Frame and white brick construction, concrete foundation, shingle roofing.

Quebec, Que.

A residence is being built on Fourth Avenue by day labor for E. Belanger, 331 Fourth Avenue, Limoilou. Sub-contracts will be let for roofing, plastering, painting, heating, plumbing and electrical work.

A residence is in course of erection on Lockwell Street for E. C. Brochu, 147 St. Cyrille Street. Work by day labor. Concrete foundation, brick construction, metal roofing. Approximate cost, $3,000.

Toronto, Ont.

S. Robertson, 1006 Logan Avenue, is receiving tenders on plumbing, plastering and electrical work in connection with the residences in course of erection on Berwick Avenue.

J. F. Alexander, 8 Temple Avenue, has let the contract for the erection of a residence at Temple and Dufferin Streets to W. B. Charlton, 412 Indian Road. Estimated cost, $5,000.

In connection with the residence being built on Melgund Road for R. Connable, 228 Balmoral Road, the contract for masonry has been let to Smallwood Bros., 97 Clinton- Street, and for carpentry to J. C. Scott, 106 River Street.

R. E. Hicks, 192 Western Avenue, has let the plumbing contract in connection with the residence in course of erection at 103 Woodside Avenue to E. Hume, 146 Vine Street. Contracts for painting, heating and electrical work will be let.

W. A. Taylor, 4 Laurier Avenue, has commenced the erection of a residence at 182 Keewatin Avenue, estimated to cost $3,000. Smaller trades will be sub-let. Brick construction, shingle roofing.

S. B. Green, 650 Annette Street, has started work on the erection of a residence on Evelyn Crescent, and will sublet smaller trades. Brick construction, shingle roofing. Estimated cost, $3,000.

A. Edwards & Spiers, 1028 St. Clair Avenue W., have started work on a residence at 191 Lauder Avenue, estimated to cost $5,000. Smaller trades will be sub-let. Stone and brick construction.

A. R. Doherty, 56 St. Andrew's Gardens, has commenced the construction of a brick residence, estimated to cost $4,500.

A residence is in course of erection at 146 Glenholme Avenue, for C. R. Britnell, 73 Alberta Avenue. Stone and brick construction. Estimated cost, $5,000. Smaller trades will be sub-let.

The Reliance Building Company, 70 King Street E., are erecting three pairs of residences on Gerrard Street E., estimated to cost $10,200. Brick construction, shingle, felt and gravel roofing.

A pair of residences is being built at 134 Glenholme Avenue by day labor for R. T. Walker, 39 Frederica Street. Brick construction, stone foundation. Approximate cost, $8,000.

Tenders on smaller trades for the residence in course of erection at 76 Regal Road are being received by J. D. Naylor, 110 Glenholme Avenue.

Work has been commenced on the erection of a residence at 5 Wells Hill Avenue by L. J. Bland, 18 Vermont Avenue. Brick construction, shingle roofing. Estimated cost, $3,800.

W. H. Umphrey, 83 Wellesley Street, is erecting a pair of residences on Kent Road. Smaller trades will be let. Estimated cost, $6,000.

R. Robertson, 57 Armand Avenue, is receiving tenders on all trades required in the erection of an addition to his residence.

Work has been started on the erection of a residence on Thorne Crescent by J. Edmonds, 71 Oakwood Avenue. Smaller trades will be let. Approximate cost, $3,500.

Work has been started on the erection of a pair of residences on Gillard Street by J. R. Gifford, 195 Browning Avenue. Contract for smaller trades will be let. Brick construction, shingle, felt and gravel roofing. Approximate cost, $3,500

Vancouver, B. C.

A permit has been issued to B. J. Short for the erection of a residence at 966 Fourteenth Avenue W., at an estimated cost of $4,500. Frame construction. Architects, J. P. Matheson & Son, 509 Richards Street.

Victoria, B. C.

Tenders on the erection of a residence on Little Saanich Mountain will be received until 4 p.m., August 20th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications at office of W. Henderson, Resident Architect, Victoria, B. C., at the Post Office, Vancouver, and at the Department. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Westboro, Ont.

W. Fields has commenced the erection of a number of residences, estimated to cost $4,500. Brick veneer construction, stone foundation, shingle roofing.

Windsor, Ont.

Labert & Braithwaite, 10 Reveri St., are erecting a residence, estimated to cost $4,000. Brick construction, shingle roofing.

CONTRACTS AWARDED

Agincourt, Ont.

Work has been started on the erection of a residence for Miss E. Armstdong, Agincourt. The general masonry and carpentry contracts have been let to W. H. Patterson, Agincourt. Smaller trades will be let by the general contractor. Approximate cost, $5,000.

Galt, Ont.

The following contracts have been let in connection with the erection of a residence at Brant and Aberdeen Streets for J. R. Blake, Gilholm Avenue:—brickwork and masonry, Thomas & Hancock, Wellington Street; carpentry, George Murray, Victoria Avenue; plastering, Will Mogg, Brant Road; painting, A. G. Bruce, Main Street; heating, plumbing and electrical work, Scott & Bennett, Water Street N.

Halifax, N. S.

In connection with the residence in course of erection on Young Avenue for A. O. Saunders, 14 Lucknow Avenue, the masonry, carpentry and steel contracts have been let to the general contractors, Rhodes Curry Company, Windsor Street, the painting contract to Martin & Moore, 247 Barrington Street, and the contract for heating, plumbing and electrical work to Farquhar Bros., Barrington Street.

Frank Settle, Cole Harbour Road, is building a number of flats on Walnut Street for Gertrude Settle. Frame construction, concrete foundation, felt and gravel roofing. Estimated cost $3,000.

Herbert Hartlen, 299 Gottingen Street, has let the general contract for the erection of three residences on Longard Road to Guzer Bros., care of owner. Frame construction, concrete foundation, felt and gravel roofing. Approximate cost, $6,000.

Hamilton, Ont.

W. C. Armstrong, 119 Hugson Street S., has let the masonry contract for the erection of a residence on Burris Analon Place to Isbister Bros., 125 Wellington Street S., and the carpentry and roofing contract to J. Vickers, 258 Rosslyn Street W. Other trades not yet awarded. Estimated cost, $4,500.

Montreal East, Que.

The general contract for the erection of thirty residences on Dube Avenue for Cie de Construction de Maisons, d'habitation Salubre, Ltd., has been let to C. Durocher, Montreal East. Estimated cost, $75,000. Brick construction, felt and gravel roofing.

Ottawa, Ont.

Work has been started on the erection of a residence on Wendover Street for I. M. Bower, 133 Hopewell Street. The heating and plumbing contract has been awarded to J. Gervin, Bank and Sunnyside Streets, and the electrical work to Dominion Electric Company, 417 Sparks Street.

Work is under way on the erection of a residence on Centre Street for F. Carl, care of the McAuliffe Lumber Company. The masonry contract has been let to R. Beattie, Renfrew Avenue. Lumber will be purchased from the McAuliffe Lumber Company. Approximate cost, $5,500. Brick veneer construction, stone foundation, shingle roofing.

In connection with the apartments in course of erection for J. Lorne Graham, 202 Laurier Avenue W., the plastering contract has been let to Thomas Jarvis, 18 Fourth Avenue

In connection with the apartments in course of erection at Laurier and Chapel Streets for Leon Petegorsky, 87 Goulbourne Avenue, the contract for brickwork has been let to A. St. George, Somerset Street E., and for electrical work to L. Stewart. Carpentry and roofing will be done by owner. Plastering and painting not yet awarded.

In connection with alterations to a residence on James Street for P. J. Powers, 432 Wellington Street, the painting contract has been let to W. Howe, 318 Bronson Street, and the wiring contract to Costello & Crowe, 380 Bank St. Heating and plumbing will be done by day labor.

Quebec, Que.

J. Carmichael, Notre Dame des Laurentides Street, has commenced the erection of a residence, estimated to cost $6,000. The masonry and carpentry contracts have been awarded to Dallaire & Tremblay, 194 Fourth Street, Limoilou. Frame and brick construction.

Sherbrooke, Que.

In connection with the residence erected on Brooks Street for W. J. McManamy, Moore Avenue, the contract for heating and plumbing has been let to O. Trudeau, 227 Wellington Street, and for electric wiring to the Electrical Repair & Supply Company, 71 Wellington Street.

Westmount, Que.

The contract for heating and plumbing at the residence in course of erection on Westmount Boulevard for Mrs. L. C. Fee has been let to F. J. Friedman, 357 St. Catherine Street W.

Winnipeg, Man.

The electrical work and plastering at the residence in course of erection on Niagara Street for Purcer Bros., 501 McIntyre Block, will be done by the owners. The painting contract has been let to Thomas Sutton, 35 Stratford Hall, Winnipeg.

Winthrop, Ont.

The general contract for the construction of a residence for J. H. Campbell has been awarded to Charles MacNamara, Seaforth, Ont. Approximate cost, $4,000.

Power Plants, Electricity and Telephones

Brantford Township, Ont.

Negotiations are now progressing between the Township Council and Brantford Hydro-electric Commission for the construction of a power transmission line. Engineer, L. C. Ireland, Brantford Hydro Electric Commission, 7 George Street, Brantford.

British Columbia Province

The British Columbia Telephone Company, 555 Seymour Street, Vancouver, are contemplating considerable extensions in the Fraser River Valley. White Rock, Cement Beach and Ocean Park will be connected with Cloverdale, involving the construction of 28 miles of line.

Hamilton, Ont.

The Great North Western Telegraph Company, the Bell Telephone Company and the C. P. R. Telegraph Company are about to install all their lines in underground conduit.

Palmerston, Ont.
A by-law providing for the installation of a hydro-electric system will be submitted to the ratepayers on August 7th. Town Clerk, H. Hyndman.

Petrolia, Ont.
A by-law has been carried authorizing a bond issue of $35,000 for the installation of a hydro electric system and plant. Town Clerk, J. McHattie.

CONTRACTS AWARDED

Zelma, Sask.
The contract for the construction of a telephone system for the Zelma Rural Telephone Company has been let to George Foley, Box 355, Saskatoon, at $6,725. Equipment for about 35 miles of line and 35 phones will be purchased by contractors.

Fires

Berwick, N. S.
Fire has destroyed the planing mill of J. W. Hutchinson, Commercial Street, causing a loss of $10,000. The evaporating plant of the Berwick Fruit Company, Mill Street, was also damaged to the extent of $1,500.

Chicoutimi, Que.
The store and residence of J. T. Laferriere have been destroyed by fire. Loss, $7,000, covered by insurance. Owner will rebuild.

Ditchfield, Que.
Fire has destroyed the saw mill belonging to P. H. Renaud. Loss, $6,000, covered by insurance. Owner will rebuild.

La Tuque, Que.
Omer Giguere's garage has been totally destroyed by fire. Loss, $9,000, covered by insurance. Owner will rebuild.

Little River, N. S.
A. Thomson's residence and outbuildings have been completely destroyed by fire.

Martintown, Ont.
Fire has destroyed A. D. Clingen's sawmill. Loss, $8,000.

Orillia, Ont.
The Municipal Building and Opera House have been destroyed by fire. Estimated losses, Town, $25,000, insurance $19,000; T. W. Robbins, lessee of the Opera House, $3,000, small insurance. The Town Council have decided to rebuild, and will ask for competitive plans. Clerk, C. E. Grant.

Plaster Rock, N. B.
The following properties have been destroyed by fire:—hotel, owned by Washburn Turner, grocery store, C. L. Bent, residence, George Ridgewell.

St. Theodore d'Acton, Que.
The following losses have been caused by fire:—bakery and residence, Hector Belanger, $6,000, covered by insurance; store and residence, Mrs. N. Decelles, $7,000, fully insured. Both owners will rebuild.

Fire has destroyed the grist mill, blacksmith shop and residence of Rene Desantels. Loss, $10,000. Owner will rebuild.

Wallaceburg, Ont.
A business block has been destroyed by fire, with a loss of $5,000. Occupants, Jones & Bachus, proprietors of the Ideal Laundry, A. Sterling, store, and Chinese laundry.

West Broughton, Que.
A saw mill belonging to T. Beaudouin has been destroyed by fire. Owner will rebuild next year.

Miscellaneous

Berlin, Ont.
Tenders on the supply of a street sprinkler and flusher will be received until July 29th by the Chairman of the Street Sprinkling Committee.

Colborne, Ont.
A by-law providing for the purchase of a fire engine has been passed. Town Clerk, H. S. Keyes.

Halifax, N. S.
A. A. McDonald, Water Street, Halifax., is in the market for builders' and woodworker's supplies, plant and machinery.

Levis, Que.
The City Engineer, C. Lessard, has been authorized to purchase a carload of pipe clay.

New Brunswick Province
Tenders on dredging at Grand Lake, St. John River, will be received until 4 p.m., August 3rd., by R. C. Desrochers, Department of Public Works, Ottawa. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto, and at the Department. Approximate quantity, 75,000 cubic yards.

Springhill, N. S.
The Springhill Manufacturing Company are receiving prices and catalogues on plate glass, fireproof doors, metal sash shutters, skylights and ventilators.

St. Joseph, Ont.
N. A. Cantin, St. Joseph, Hensall, Ont., is in the market for a quantity of cement.

St. Thomas, Ont.
The St. Thomas Construction Company, Limited, are in the market for machinery for the manufacture of shrapnel and high explosive shells and other ammunition. A. E. Ponsford, 605 Talbot Street, is an interested party.

Yamachiche, Que.
Quotations and catalogues on plumbing, heating and ventilating supplies and equipment are being received by N. Deschesne & Company, Three Rivers.

CONTRACTS AWARDED

Chatham & Dover Townships, Ont.
A contract for dredging has been let to Alexander Clifford, 701 Centre Avenue, Bay City, Mich., at $29,323.

Transcona, Man.
The Town Council have let the contract for the installation of an incinerator to the Ideal Incinerator Company, Manning Arcade, Toronto, at $18,875.

Late News Items

Assiniboia, Man.
Tenders on laying watermains will b received until August 2nd by Frank Ness Kirkfield Park.

Edgeley Station, Sask.
Tenders on the erection of a school for the Trustees of Donamar Rural School District No. 3570, will be received until August 5th by R. B. Heron, Avonhurst P. O., Sask. Plans and specifications at office of the Western School Supply Company, Regina, and with William Rogers, Edgeley, Sask.

Exeter, Ont.
A by-law has been carried, providing for the installation of a hydro-electric system, at an approximate cost of $20,000. Work to be done under supervision of the Engineers of the Hydro Commission.

Grantham, Ont.
A. E. Nicholson, Architect, 46 Queen Street, St. Catharines, is receiving tenders on the erection of a two-roomed school on Queenston Street, School Section No. 6. Concrete foundation, brick and tile construction.

Lac au Saumon, Que.
A contract for water-works construction has been let by the Municipality to A. Landry & Fils, Lac au Saumon. Approximate cost, $19,000. Wood pipe, douglas fir and cast iron pipe will be required.

Markham, Ont.
E. A. James, 57 Adelaide Street East, has submitted a report to the Village Council estimating the proposed extension to the water-works system at $15,000. This figure includes a standpipe with a capacity of 60,000 gallons.

Montreal, Que.
Work has been commenced by D. Lamoureux, 1923 St. Lawrence Street, on the erection of six flats on Mozart Street, estimated to cost $6,000.

Orillia, Ont.
The residence of Benjamin Cole on Hilda Street has been completely destroyed by fire.

Starkville, Ont.
The sawmill owned by F. Jackson has been completely destroyed by fire

St. Catharines, Ont.
The general contract for the erection of a business block on James Street for J. Balsam, 29 James Street, has been awarded to Newman Bros., 75 St. Paul Street. Approximate cost, $15,000.

Tilbury East Township, Ont.
The Township Clerk, A. Farquharson, Merlin, will receive tenders until August 2nd on dredging the Dauphin Drain and on road grading. Plans at office of Clerk.

Tuckersmith Township, Ont.
Tenders on new flooring for four bridges will be received until August 4th by D. F. McGregor, Seaforth.

Welland, Ont.
Frank Springer, 59 Merritt Street, has prepared plans of a store to be built on Burgar Street for Samuel Lambert, 56 Main Street N. Estimated cost, $10,000.

Winnipeg, Man.
Tenders on the installation of a heating system at the Polson Avenue School will be received until August 5th by the Public School Board.

All Kinds of Machinery Can Be Driven By De Laval Steam Turbines

The De Laval Double Helical Speed Reducing Gear makes it possible to use the turbine for driving slow speed machinery, such as rolling mills, paper machines, or for rope or belt drives, for driving centrifugal pumps, blowers and compressors for all pressures and capacities and for driving standard A.C. and D.C. generators.

Direct connection of the turbine to the driven machine eliminates the cost and losses of transformers, motors, etc. By using a mixed-flow or low pressure-turbine, additional power can often be obtained by utilizing exhaust steam now going to waste, thus saving the cost and expense of operation of additional boiler plant. The combination of reciprocating engine and low pressure turbine gives the very highest efficiency. By arranging the turbine so that it can be operated with high pressure steam when necessary, a plant of extraordinary flexibility and sustained economy is obtained. Read our Treatise D62 on "Steam Turbines and Their Uses."

De Laval Steam Turbine Co.
TURBINE EQUIPMENT CO., LIMITED
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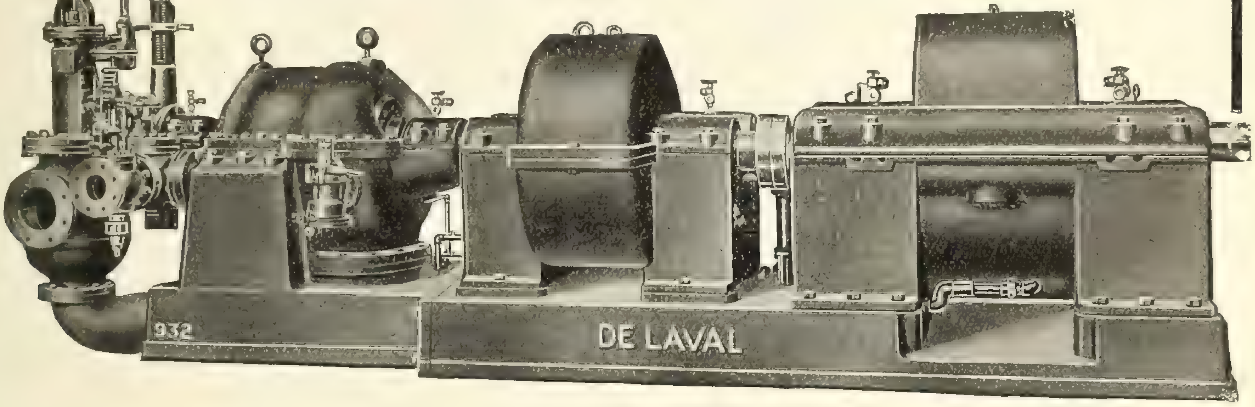
THE E. LAURIE CO.
243 Bleury Street, MONTREAL, Que.



De Laval multi-staged mixed-flow and double gear reduction for direct connection to rolling mill; 750 H.P.; turbine speed 5000 r.p.m. rolling mill 100 r.p.m.

RAILS New and Relaying Switches, Turntables, Etc.

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Advertising is an insurance policy against forgetfulness. It compels people to think of you.

Contract Record
and Engineering Review

Toronto Montreal Winnipeg
Vancouver London, Eng.

Tenders and For Sale Department

Sprinkler Wanted

Time Extended

Tenders for a motor-driven combination street sprinkler and flusher will be received by the Sprinkling Committee up to **August 5th, 1915.** For further particulars apply to G. G. Bucher, Chairman Sprinkling Committee, or A. H. Millar, City Clerk, Berlin, Canada. 30

FOR SALE

Large Manufacturing Plant, Near Wiarton

Suitable for manufacturing marl or rock cement. Power plant consists of three 400 h.p. engines, in first-class condition. G. T. R. siding, docks, etc. Apply The Toronto General Trusts Corporation, Toronto. 30

Tenders for Foundry

Sealed tenders will be received by the undersigned up to **July 29th** for the erection and completion of a Foundry Building at Brighton. All tenders to be marked "Tender for Foundry." Plans and specifications may be seen at the office of the secretary.

Lowest or any tender not necessarily accepted.

GEO. DREWRY,
Secretary of The D. J. Barker Foundry Company, Limited,
29-30 Brighton, Ont.

TENDER

For the Filling in of Catfish Pond and the Construction of Sewer in Connection Therewith

Tenders will be received through registered post only, up to noon on **Tuesday, August 17th, 1915**, for the filling in of Catfish Pond and the construction of sewer in connection therewith.

Tenders must be addressed to the Chairman, Board of Control, City Hall, Toronto, and be plainly marked on the outside of the envelope as to contents.

Specifications and forms of tender may be obtained upon application at Room No. 311, Department of Works, City Hall, on payment of five dollars ($5.00), this sum to be refunded upon return of plans.

Tenderers must comply strictly with conditions of City By-law as to deposits and sureties as set out in specifications and forms of tender.

The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
30 Chairman, Board of Control.

WANTED

Double deck iron cars, suitable for drying bricks in tunnels. Apply Box No. 224, Contract Record, Toronto. 30-31

CITY OF REGINA

Waterworks Department

Sealed tenders will be received by the City Commissioners up till noon, **Monday, September 6th, 1915**, for the supply, delivery and erection of a 7,000,000 gallon Pumping unit at the City Power House, Regina, Sask.

Specifications and other information may be obtained from the office of the undersigned. The City does not bind itself to accept the lowest or any tender.

J. M. MACKAY,
Superintendent of Waterworks.
July 22nd, 1915. 30-31

Contractors

Tenders will be received by the undersigned up to and including **Tuesday noon, August 3rd, 1915**, for the undermentioned trades required in the erection of a factory building for The T. Eaton Company, Limited, at Hamilton, Ont.

Brick and Stone, Masonry, Reinforced Concrete, Cut Stone, Interior Marble Work, Ornamental Iron Work, Cast Iron, Cement Flooring, Sheet Metal, Mill Work, Hardware, Tanks, Cold Water Painting, Painting, Glass Glazing, Rolled Steel Sash, Rolling Steel Doors, Ornamental Terra Cotta, Plaster, Vault Door, Cabinet Work, Roofing and Waterproofing, Radial Brick Stack.

Plans and specifications may be seen and form of tender obtained by applying at our Engineer's Office, Louisa Street, Toronto, or at our Construction Office, corner of Gore and John Streets, Hamilton, Ont. We reserve the right to reject any or all tenders, and to accept the whole or any part of a tender.

The T. EATON CO., Limited.

Heating Hub of Turbine Spider Saves Four Days' Time in Mounting

By Harold F. Johnston

Instead of taking four days to put a 27-ton spider on a 11-in. shaft with a 100-ton hydraulic press an erection superintendent in Alberta recently succeeded in making a satisfactory mounting in less than four hours by heating the hub of the spider enough to expand it a little. The cost of mounting the spider in the press would have been $60, while the actual operation performed cost only $5. As time was a most important factor in the contract, however, the saving of over three and one-half days was of much more value that the small saving of labor.

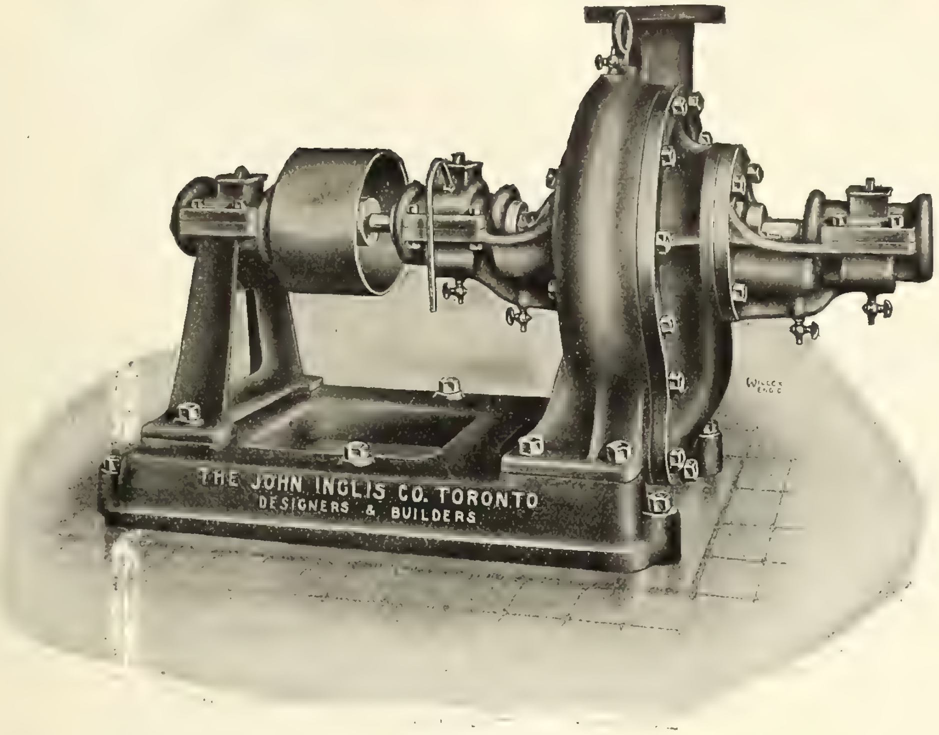
The spider carried the rotor and field coils. It had to be keyed to a 15-in. vertical shaft directly connected through a coupling to the turbine shaft. The shaft was first mounted, and the coupling bolted up. The spider, on which the field coils had already been mounted, was blocked up about 9 inches off the power-house floor. A ring of sand was then built around the outside of the hub, forming a pit under the hub in which a fire of dry pine chips was built. The top of the hub was covered with steel plates to help confine the heat. One man kept tending the fire, keeping it evenly hot all around the hub for three and one-half hours. The spider was then raised by the crane and easily fitted over the shaft. It was quickly turned to the proper position, the key driven home, and the mounting completed. The job proved entirely satisfactory, and the 100-ton press sent out by the contractor to comply with the specifications was returned unused.

The installation was made by the General Electric Company of Sweden, at the plant of the Calgary Power Company, at Seebe, Alta. Two 12,000-volt, 4200-kv.a. generators were erected.

By means of a system of mirrors, Glencoe, Ill., has materially reduced accidents at one of its most dangerous street interesctions, Green Bay Road and Hazel Avenue. Both the roads approach the street intersection on the down grade, and drivers of cars passing west through the viaduct on Hazel Avenue heretofore have been unable to tell whether a vehicle was approaching from either direction along the Green Bay Road. A large mirror eight feet long and about six feet in height has been placed at the southeast corner of the intersection at such an ongle that the driver of a car approaching down the grade in Green Bay Road from the north can see a car coming west through the culvert, and give it the right of way. A smaller mirror has been placed on the side of the culvert at the northeast corner, by means of which the driver of a machine going west through the culvert can see a car approaching from the south in Green Bay Road. It is said that the mirrors are proving a success even at night, when the flare of the headlights is reflected in both directions.

An interesting point in the awarding of contracts for paving blocks has been decided by Mr. Justice Lafontaine, Montreal, who has issued an injunction asked for by Mr. C. Bernard, restraining the Board of Control from awarding contracts for 1,860,000 paving blocks. In April the city called for tenders for 100,000 blocks, for repair work, but no award was made for two months. Then the city decided to go ahead with new paving work, and utilized the bids called in April, ordering a total of 1,860,000 blocks. It was argued that if the unsuccessful tenderers had known that such a large quantity was required they would have been able to quote lower prices. For the city it was contended that it was within its legal rights in accepting the tender. The judge held that the city ought to have awarded a contract for the original quantity, and to then have called for fresh tenders for the additional number of blocks required.

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

INGLIS' PRODUCTS ARE "MADE IN CANADA"

Write us for prices.

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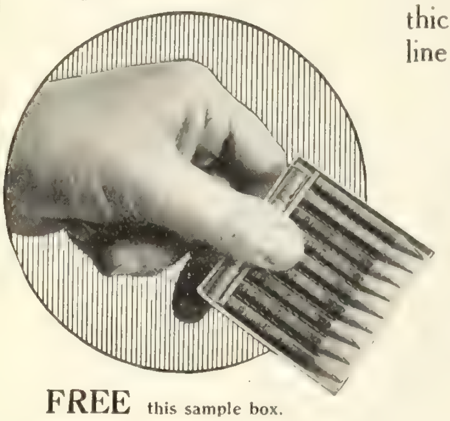
14 Strachan Ave., Toronto, Canada
Montreal Office: Room 509 Canadian Express Building
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

VENUS PENCILS

IN preparing sketches, as well as in making the working plans the engineer or draughtsman must use a pencil upon whose quality he can depend. He must be sure the weight and thickness of each line will be uniform.



He must be able to get the same quality each time he picks up a new pencil, or his entire work will have a sloppy uneven appearance.

Venus Pencils made in 17 degrees (6B softest to 9H hardest) are absolutely uniform in quality and answer every technical requirement.

FREE this sample box.

To the technical man writing on his letterhead a set of nine short samples and holder will be sent free.

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235 Fifth Ave , New York
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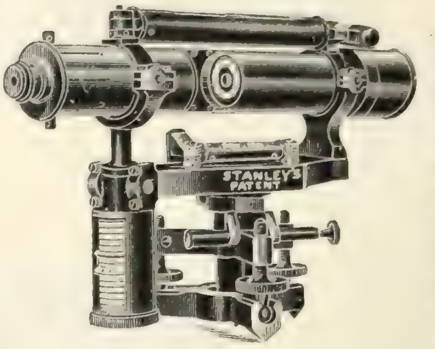

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The Largest Manufacturers of Surveying and Drawing Instruments in the World.

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Please send for our catalogue "K 91" and compare our prices with those of other *first-class* makers.

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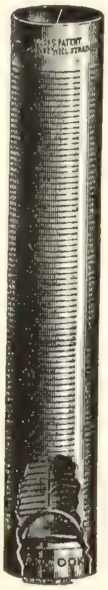
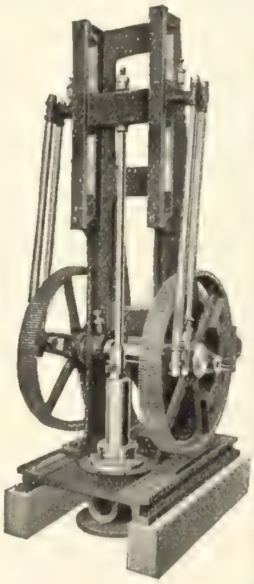
286 High Holborn, LONDON, ENGLAND



Water Supply from Deep Wells

is obtained at a minimum cost by use of our deep well pumps.

Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer.



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Lawrenceburg, Indiana, U. S. A.

Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS**, Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

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Dickson Bridge Works Co.

Campbellford, Ont. Limited

Bridge over Spanish River at Massey, Ont.

Steel Bridges, Steel Buildings Roof Trusses

and other Structural Steel

Foundry and Machine Shop in connection.

Estimates on application

Made in Canada

Beaconsfield, Station Road,
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Better Roads and Lower Taxes—

The automobile has radically changed the problem of the road builder. What is required now is a form of road construction which will not only give a good surface the whole year round, but which will be able to withstand motor traffic.

Tarvia furnishes the solution.

Tarvia is a dense, viscid coal tar preparation. It is made in several grades to meet varying road conditions. Used in road construction it forms a matrix about the stone, making a tarvia-concrete which is waterproof and automobile-proof. As it is slightly plastic it is not abraded by automobile driving wheels, but is simply rolled down smooth allowing no dust or mud to form.

The cost of maintenance is so greatly reduced by the Tarvia treatment that its use is a real economy.

Suburban streets should be treated with Tarvia to secure a handsome, cleanly, mudless pavement at low cost. Country and state thoroughfares and highways should be treated with Tarvia to keep down maintenance expense.

Special Service Department.

This Company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by anyone interested.

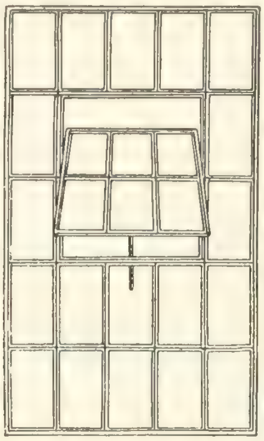
If you will write to the nearest office regarding road problems and conditions in your vicinity the matter will have prompt attention.

THE PATERSON MANUFACTURING COMPANY, LIMITED
MONTREAL TORONTO WINNIPEG VANCOUVER

THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N. B. HALIFAX, N. S. SYDNEY, N. S.

The Ormsby-Lupton Steel Sash

The Superior Steel Sash



Gives Fire Protection

Lowers Insurance Rates

Can be purchased very little in advance of the price of Wooden Sash.

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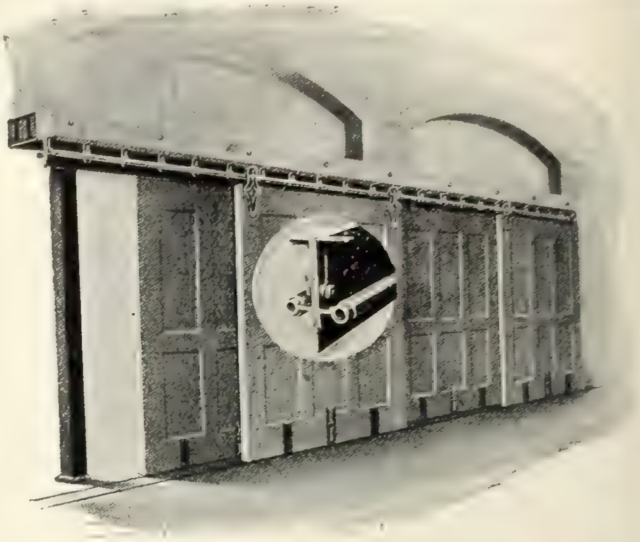

We can supply you with Hangers to carry **any size door and**

Parallel Equipment

in the **strongest style** of track.

The Round Track with **Adjustable Supports.**

Manufacturers of
The best goods in the hanger line

ALLITH MFG. CO., LIMITED
HAMILTON

Keith Fans

The opportunity for greater economy and efficiency in **Heating and Ventilating** is emphasized in the **"Keith" Fan.** Comparative tests of other types of fans have resulted in the **"Keith"** being proclaimed the most efficient and economical in the Fan World. Write for our New Catalogue No. 55.

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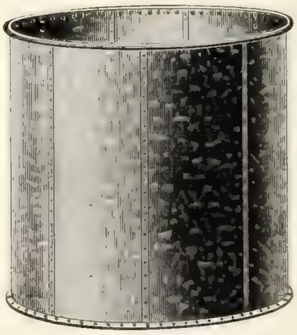

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Prices quoted promptly on heavy galvanized steel tanks for every purpose.

Wayne Measuring Systems for handling your gasoline and oils will save you money.

Wayne Oil Tank & Pump Co.
Limited
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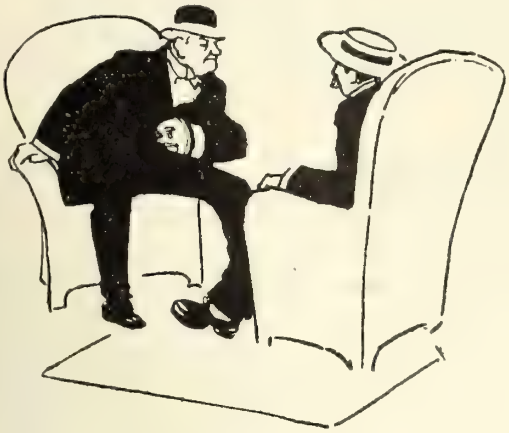

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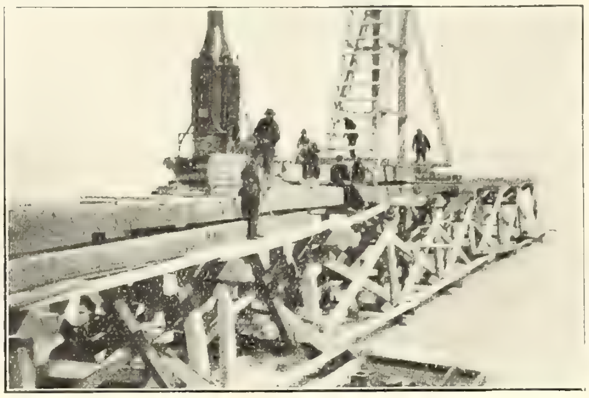

M & H Hoisting Engine driving Piles in Harbor at Port Weller, Ont.

Standard Machines in stock. Prompt shipments.
Prices moderate

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Towers and Tanks for all purposes.

Concrete Mixers

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Water supply outfits of every description.
CORRESPONDENCE SOLICITED

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5 Floors of This New Building, For Office and Warehouse Use.

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This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

- Centrally located at Adelaide and Charlotte Streets.
- Light on four sides
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- One block from four car lines
- Floor area 6,300 sq. feet, each floor.

For further particulars ask

Hugh C. MacLean, Limited
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BOOKS

For Engineers and Contractors

The following Books are Offered subject to Previous Sale:

British & Foreign Building Stones, by John Watson, Published in 1911 at the University Press, Cambridge, England. 483 pages. Price 50 cents.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

Contract Record
347 Adelaide St. West, Toronto, Ont.

DUMB WAITERS

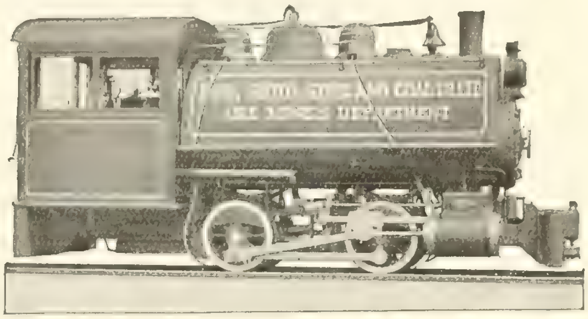
Roelofson self retaining dumb waiters are fast replacing the old styles.

They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of costs for special machines to be used as wall hoists, freight or invalid elevators.

Roelofson Elevator Works
Galt, Ont

INDUSTRIAL LOCOMOTIVES



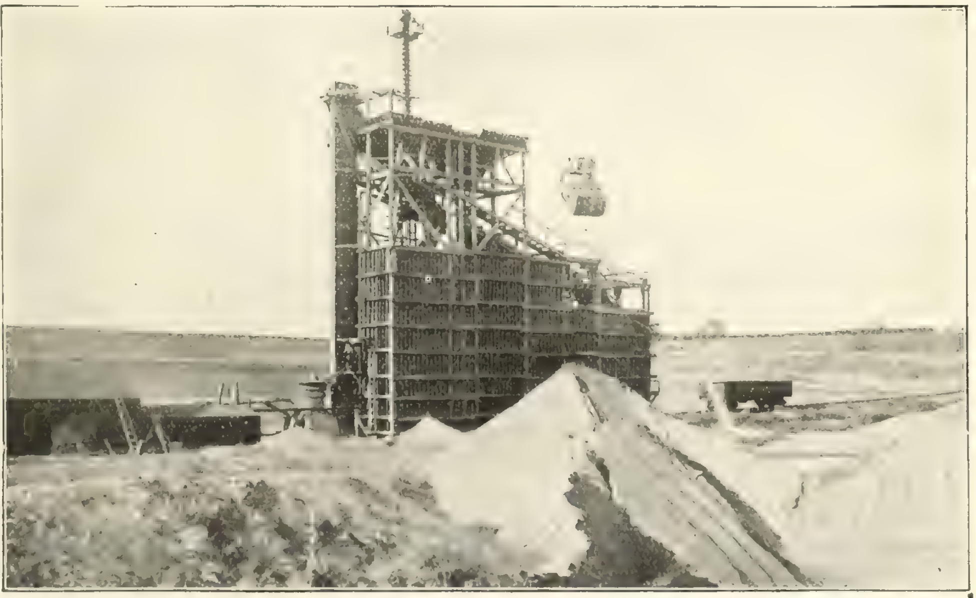
The designs of our small locomotives are the result of wide experience.

All details are accurately finished to standard gauges and are absolutely interchangeable on all locomotives of the same class and size.

This cuts out long delays when parts wear out, as parts liable to wear can be kept on hand or shipped promptly from our works.

MONTREAL LOCOMOTIVE WORKS, LIMITED
DOMINION EXPRESS BUILDING, MONTREAL, CANADA

"DULL" Sand and Gravel Plants



"Dull" Sand and Gravel Plants are made to include the operations of obtaining the material and conveying it to the plant for washing and sorting into various sizes. We have had wide experience in designing and erecting hundreds of plants for a variety of uses and under all conditions. The illustration shows a "Dull" plant with sand and gravel being excavated and conveyed to plant by a "Dull" drag line excavator. "Dull" improved conical screens are arranged to make two sizes of sand and two of gravel.

Write us for our illustrated Catalogue.

The Raymond W. Dull Co., 111 Washington St., **Chicago**

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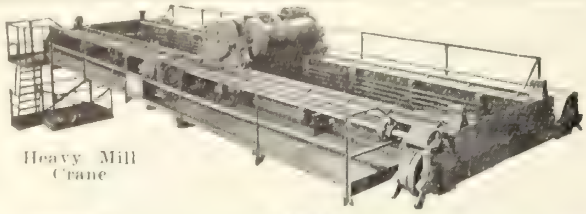
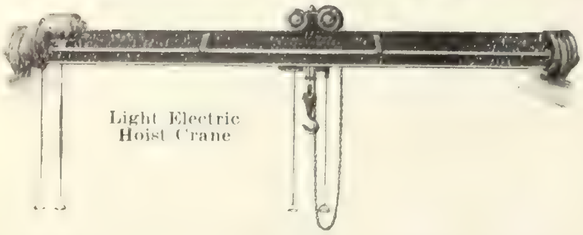
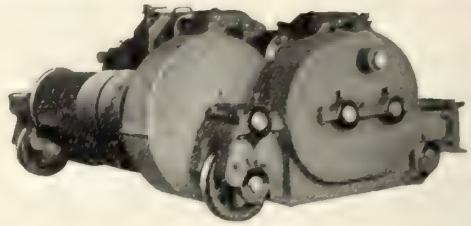
Mills Bros., 215 Ryrie Bldg., TORONTO   Bentz-Richardson Co., WINNIPEG


Heavy Mill Crane


Light Electric Hoist Crane



The Ideal
Crane
Trolley →
Northern
"Type E"

CRANES MADE IN CANADA
OF ALL TYPES, SIZES AND CAPACITIES

Heavy Cranes and Light Cranes for Mill Service, Power Stations, Foundries, Stone Trades—Grab Bucket Cranes

Northern Crane Works, Limited, WALKERVILLE, ONTARIO

HERRINGBONE COPPER ALLOY LATH

WHY COPPER ALLOY

All Herringbone lath is now made from copper alloy instead of ordinary steel. This change costs the manufacturers and dealers in Herringbone Copper Alloy Lath thousands of dollars a year. It costs the consumers nothing.

The group of business men interested in promoting Herringbone sales expect the increase in the volume of business to compensate them for the decreased profit per yard. This increase can only result from a definite improvement in Herringbone quality. They therefore demanded the most searching tests before adopting the new policy.

These tests consisted of seventy-five quantitative measurements of actual corrosion of plain steel bedded in hard wall plaster as compared with seventy-five identical tests on copper alloy. Five different brands of plaster were used. The time tests were continued until corrosion on copper alloy (but not on plain steel) had ceased. The average of all these tests showed that copper alloy is sixty-one per cent. more efficient than plain steel in resisting hard wall plaster corrosion. Ask for the booklet "Why Copper Alloy?"

Clarence W. Noble - General Sales Agent

117 Sun Life Building, Toronto

Metal Shingle & Siding Company, Manufacturers

BISHOPRIC
STUCCO BOARD

makes Stucco and Plaster Walls warm, dry and permanent.

Plaster or cement applied to Bishopric Stucco Board wedges tight into the dovetailed spaces between the bevel-edged laths, forming "keys" that are stronger than can possibly be made on wood or metal lath. The heavy layer of Asphalt-Mastic in the Stucco Board makes walls absolutely wind and damp-proof, and therefore warm. And the cost is surprisingly low.

Write for samples and particulars about Bishopric Stucco Board, Lath Board and Sheathing, and Permatite Roofing, to

26

The Bishopric Wall Board Co., Limited, Office and Factory: **538 Bank St., Ottawa, Canada**

We design, furnish machinery for, and build complete

MINING PLANTS,
CRUSHING PLANTS,
HYDRATED LIME PLANTS,
and Gravel and Coal Handling Equipment

Rock & Power Machinery Co.
58 Church Street - - TORONTO

Sales Offices
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Beams—Channels
Angles—Plates
Always in Stock

Reinforcing Bars
'Self-Sentering"

Corrugated
Sheeting
Send for Stock List

STANDARD STEEL CONSTRUCTION CO.
LIMITED
WELLAND - CANADA
MANUFACTURERS AND ERECTORS
Steel Buildings and Bridges

BITUNAMEL

Unsurpassed for waterproofing foundations and preventing rust and corrosion on exposed iron and metal work.

WRITE FOR SAMPLE

The Ault & Wiborg Co. of Canada Ltd., Varnish Works
Montreal TORONTO Winnipeg

STRUCTURAL STEEL FOR QUICK DELIVERY

We carry in stock at Montreal 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

Bridges, Roof Trusses, Columns, Girders, Beams, Towers and Tanks, Penstock.

Estimates furnished promptly, Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
Main Office and Works, Montreal

Do You Want Crushed Stone?

That is Clean, Tough Stone of a Quality suitable for Macadam Road and Concrete

We can supply you in any size or quantity.
Our service is unexcelled and our prices right.
Phone or write us for quotations when you are in the market.
Office—M 4515—M 4516 Residence—P 2278

Crushed Stone Limited
47 Yonge St. Arcade, Toronto
G. W. Essery, Manager

ARE YOU GOING TO BUILD?

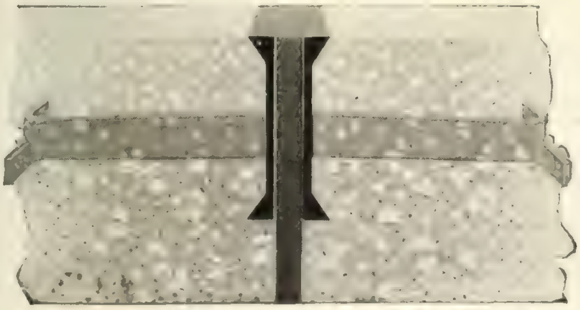
Before erecting your new building you should consider the possibilities and many advantages to be gained by the use of

"AMERICAN" Enameled Brick

Write for catalogue, also samples, miniature or full size.

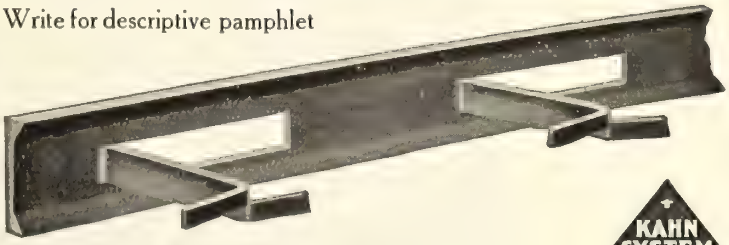
AMERICAN ENAMELED BRICK & TILE COMPANY
1182 Broadway, New York.

KAHN ARMOR PLATES for CONCRETE ROADS



Cross-sectional view showing joint protected by Kahn Armor Plates with filler between them.

Write for descriptive pamphlet



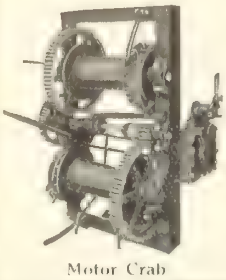
Kahn Armor Plate.

The Beveled Edge Protects the Concrete

KAHN SYSTEM Building Products

TRUSSED CONCRETE STEEL CO. OF CANADA, LIMITED, Walkerville, Ont.

STEAM and AIR ENGINES, HOISTING ENGINES, STEAM CRANE HOISTS, MOTOR CRABS, SWINGING ENGINES, DRILL HOISTS, SPUD HOISTS, MARINE MACHINERY

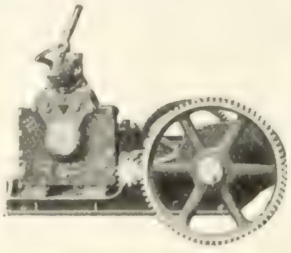


Motor Crab

Write for catalog and prices

Dake Engine Co.

Grand Haven, Mich.



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Sand, Gravel and Crushed Stone

Lime
Cement
Plaster
Hair
Fire Clay
Fire Brick
Sewer Pipe
Weeping Tile
Building Stone

Our prices are right and our service good.

Britnell & Co., Limited

C.P.R. Crossing, Yonge St., North Toronto

Phones, Office North 664, 665 Evenings, North 2107

Ornamental Lighting Poles

During the past few months we have supplied ornamental lighting standards for the following places:—

Brantford, Ontario
Edmonton, Alberta
Windsor, Ontario
Outremont, Quebec
London, Ontario
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Listowel, Ontario
Peterborough, Ontario
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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

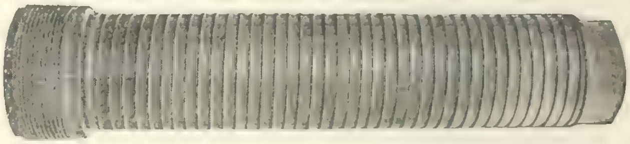
We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

William Hamilton Company

Peterborough, Ontario

VANCOUVER WOOD PIPE & TANK CO., LTD.



Contractors for Waterworks Construction, Manufacturers of Wire-Wound Wood Pipe, Continuous Stave Pipe, Tanks, Silos, Steam Casing.

See our new patented Wood Pipe Coupling—Positively LEAK PROOF.

Wrte for 1915 Catalogue

319 Pender St. VANCOUVER, B.C.

"Galvaduct" and "Loricated"

Conduits

for Interior Construction

Conduits Company, Limited

Sole Manufacturers under Canadian and U. S. Letters Patent

Toronto - Canada

Cawthra Mulock, President Gordon F. Perry, General Manager

NATIONAL IRON WORKS, Limited

Head Office, Works and Docks:—TORONTO

every size for Water, Gas, Culvert or Sewer, Carried in Stock at

Lake or Rail Shipments TORONTO and PORT ARTHUR

Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of terrific usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

Send for catalogue and prices

Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

"Metallic" Building Materials

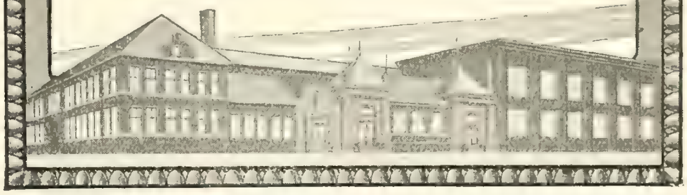
Sample Free along with Advertising Matter

We give you splendid assistance in getting the Metallic Ceiling business. And there's a lot of it about, for METALLIC CEILINGS and WALLS are handsome, durable, sanitary, easily cleaned and FIRE PROOF. We have attractive illustrated pamphlets ready for you to send to every customer and every possible prospect in your neighborhood. Write us to-day.

Write us for catalogue and prices today.

Metallic Roofing Co., Ltd.

Toronto *Manufacturers* **Winnipeg**



Neptune Meter Co.

Manufacturers of the well-known

TRIDENT Frost-Proof Water Meters

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SPRINKLER TANKS and TOWERS

We are the largest manufacturers in Canada of both wood and steel Tanks and substructures for factory sprinkler systems and for Municipal

Railroad and Suburban Water Supply

We shall be pleased to furnish you with all the information and data you may require on this class of work.

Send us your blue prints for estimates.

Send for special Tank and Tower Catalogue

Ontario Wind Engine & Pump Co.

Toronto Montreal Limited Winnipeg Calgary

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse,. white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12 in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.75; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. net cash. Copper bearing sheets—Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13½c basis; African hemp, 13½c; sisal rope, 10½c basis; lath yarn, 9¾c. Boiled linseed oil—in barrels, 80c per gal. of 9 lbs. Raw linseed oil—in barrels, 80c per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20. Bags 10 cents extra.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¼-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, ship-lap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots. f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

Warehouse Stocks :
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MONTREAL, QUE.
TORONTO, ONT.
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112 St. James St.
TORONTO
18 Wellington St., E.

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SYDNEY, N. S.

WIRE NAILS and other **WIRE PRODUCTS**

PILLAR
THE
IONA GYPSUM
COMPANY LIMITED
SYDNEY, N.S.
BRAND

Gypsum Products

"Pillar Brand"

Hardwall Plaster, Cement Plaster, Land Plaster
Whitewall Finish, Plaster of Paris

"Pillar Brand" Gypsum Products are calcined and prepared by expert workmen under experienced supervision. The material used is the best grade of pure Nova Scotia rock. Our facilities for handling crushed gypsum are unexcelled. Shipments by rail or water.

Write Us.

The Iona Gypsum Co., Limited

Head Office, Sydney, N. S. *Mills,* Iona, N. S.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page (66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $11.50 per 100 lbs.; boiled linseed oil, in bbls., 98 cents per gal.; raw linseed oil, in bbls., 95 cents per gal.; dry red lead, $10.00 per 100 lbs.; putty in bulk, $3.25 per bbl.; putty in 25-lb. tins, $3.75; turpentine, in bbls., 80 cents per gal. Mixed paint, ordinary colors, per gal., $3.10.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 350 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $9.00 f.o.b. warehouse, $9.00 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed butt brick $40 at warehouse; $33 in car lots; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35 in car lots, $40 in warehouse; fire clay, $12 per ton in car lots.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.25 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galavanized iron—28 gauge, $5.75 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18,in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.00 in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal. $2.75 to $3.25.

White lead—ground in oil, $11.50 to $12.50 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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NEPONSET PAROID ROOFING

is one of the best known of our brands. It is however only one of a large line. We also make NEPONSET Wall board, the most practical substitute for laths and plaster that has ever been put on the market. It is made in several finishes and its surfaces have been waterproofed so that it is all ready to apply, and needs no further decoration.

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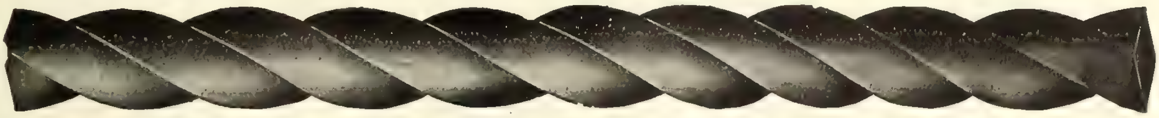

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Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

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3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

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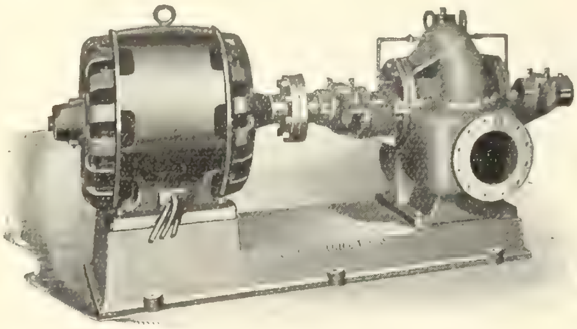

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Interlock Welded Necks

Will eliminate two-thirds of your joint trouble. How? By eliminating two-thirds of your joints with their bolts, gaskets and liability to leak. An **Interlock Neck** is much lighter than a cast iron or steel fitting, although "as strong as the pipe."

We design and execute complete piping contracts.

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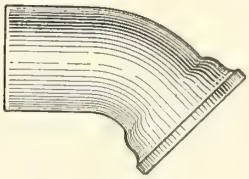

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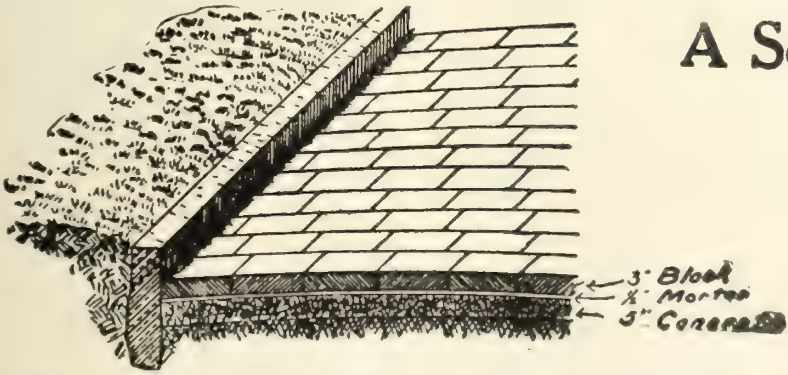

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Non-Absorbent and nearly Noiseless.
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Make your Preliminary Survey with the New
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Accurate results guaranteed.
Send for Circular.
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(MENTION THIS PAPER) M. 3713

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Cement Testing and Reinforced Concrete Inspection.
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Steel Buildings
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Locomotive Turn Tables and Structural Steel and Iron Work of all descriptions.
Estimates furnished on application.

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50,000 gallons. 149 feet to top
120,000 " 100 feet to top

Hemispherical and Segmental Bottoms

Manufactured at Pittsburgh, Pa.

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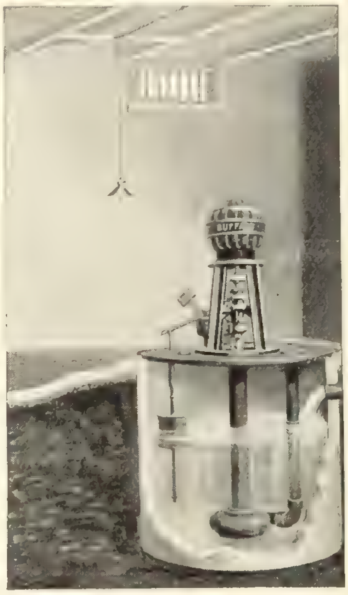

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show marked superiority over others that you will be interested in booklet 230-12.

There are hundreds of Canadian Sump Pumps in successful operation to-day, which is the very best recommendation that they are highly efficient.

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"BRADFORD REDS" — The very acme of brick excellence. Distinctive in their rich cherry red color and in their uniform high quality, year in and year out. Made in both dry pressed and impervious. The dry pressed are made in both standard and Roman sizes, with ornamentals always in stock. The impervious are made in standard size only.

"Bradford Ruffs"—Our rough-textured brick.

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We also make Fire-proofing Hollow Brick and Hollow Block.

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We are in a position to supply buff pressed brick of a most attractive and uniform colour.

Superior Quality ***Prompt Service***

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XCELADUCT

(Galvanized)

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Minimize Your Troubles by Buying Our

BLOCKS, CLIPS, THIMBLES
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Stocks carried in Montreal, Winnipeg and St. Catharines

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Manufactured by the World Famous Makers

JOHN HY. ANDREW & CO., LIMITED

Is The World's Choice

1915 Methods are CHEAPER

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Vol. 29 Toronto, August 4, 1915 No. 31

ESTABLISHED 1886

Contract Record and Engineering Review

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TO THE TRADE

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Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements Page 6

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DOMINION BANK BUILDING
Darling & Pearson, Architects

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The Terra Cotta for both buildings was manufactured and set by

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Agencies in all the large cities of Canada.

28 "Service" Branches
Throughout Canada

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And furthermore, what is equally true—no order is too small to warrant our prompt and careful attention.

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It is our desire to serve you.

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To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

from

Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

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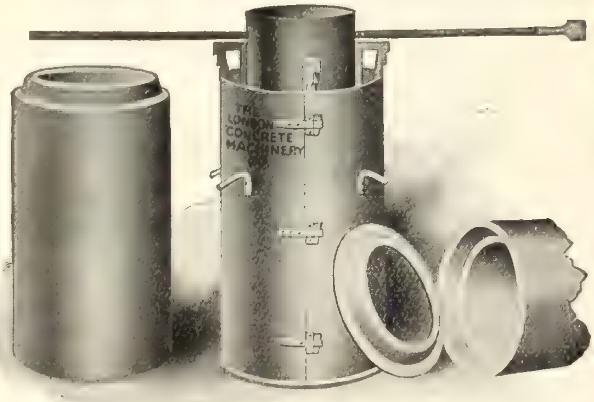

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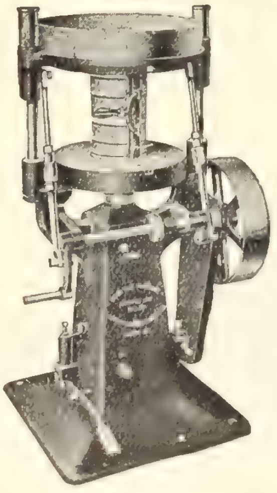
The best moulds are the cheapest. Write for catalogue N.2B.



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This Pump will do as much work as 8 men can on a hand operated pump at a cost of 15c per day for fuel.

We make all kinds of Contractors' Pumps.
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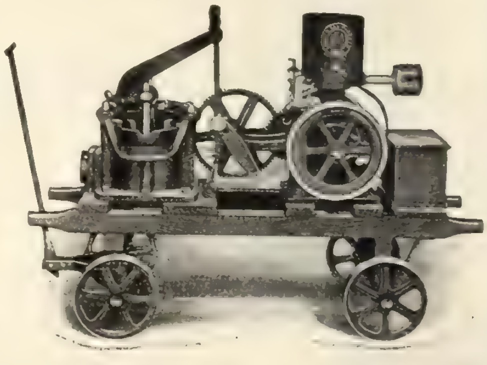
Branches and Agencies in every large city in Canada.

World's Largest Manufacturers of Concrete Machinery and Cement Working Tools.



Bank of Toronto Building, King and Bay Streets, Toronto
All Tennessee Marble "backed" with No. 110 "R. I. W."

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should be "backed" with

No. 110
"R. I. W."
Damp-Resisting
Paint

to prevent discoloration
by cement mortar

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No. 110 "R.I.W." is also used in factories, laboratories, etc., for the protection of metal or wood that is subjected to the fumes of acids or alkalies, and on structural steel imbedded in masonry.

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Railroad Depot—C. P. R., Vancouver	6 sweeper
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Trust Building—Royal Trust Bldg., Montreal.	4 sweeper
Club House—K. of C., Montreal	2 sweeper
Departmental Store—C. W. Sherwood Company, Regina	3 sweeper
School—Technical School, Toronto	8 sweeper
Hardware Store—Marshall Wells Company, Winnipeg	3 sweeper
Carpet Cleaning Establishment — Canadian Cleaning Company, Toronto	2 sweeper
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Orphanage—I. O. F., Oakville, Ont.	1 sweeper

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Turbine Equipment Company

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Browning Company

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London Concrete Machinery Co.

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Goold, Shapley & Muir Co.
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London Concrete Machinery Co.
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Browning Company
Can. Fairbanks-Morse Company
Canadian Equipment Company
Dake Engine Company
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Marsh & Henthorn
Morris Machine Works
Montreal Locomotive Works
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Goodwin, Barsby & Co.
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Pedlar People

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Browning Company
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American Enamelled Brick & Tile Company

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Beatty & Sons, M.
Dull Company, Raymond W.
Hopkins & Co., F. H.
Pawling & Harnischfeger

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Sheldons Limited

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Laurie & Lamb
McDougall Caledonian Iron Wks
Rock & Power Machinery Co.

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Cape Company, E. G. M.
Chipman & Power
Dominion Engineering & Inspection Company
Farmer, John T.
Galt Engineering Co., John
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McDougall, Geo. K.

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Filtration Plants
verMehr Engineering Co., John

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Ormsby Company, A. B.
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Steel & Radiation Limited
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(Continued on page 12)

Carried on a Foundation of Simplex Piles

the permanency of this handsome edifice, the College of Physicians, Philadelphia, is assured.

Possibly the soil under that contemplated building of yours is not any too good. Have you been following the advertisements telling of the various types of buildings that have foundations of **Simplex Concrete Piles?**

Let us send you our 96-page book on Concrete Piling. It will interest you. Yours for the asking.

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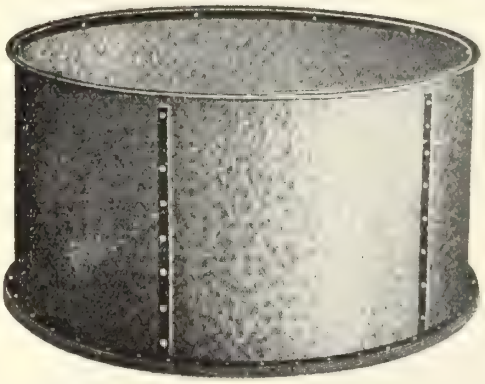
M.P.Co

Made in Canada

SARNIA STEEL TANKS
for Contractors



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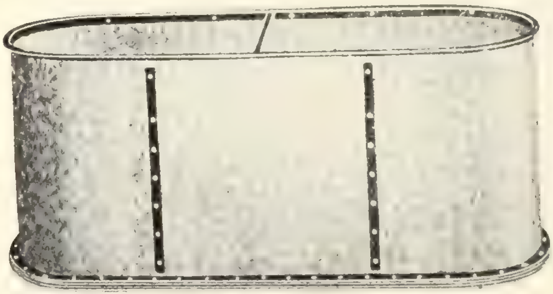
This is our most popular tank and is in great demand by contractors and builders. It is made of No. 20 gauge galvanized iron and is reinforced with heavy 1/4 inch iron strips, making it exceptionally strong and rigid.



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This round end tank is preferred by some as it is more adaptable for many purposes. Same construction and material as No. 51 above.

We also manufacture Plain Galvanized Iron, Corrugated Iron, Metal Sidings, Ventilators, Sky Lights, etc.

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Limited
Sarnia, Ontario

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Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

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WALKERVILLE, ONTARIO

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Vaults, Basement and Elevator Pit Made Positively Water-tight and Dry with CERESIT

TRADE MARK REGISTERED

Here in this bank—close to the Mississippi River—CERESIT has enabled the safe use of the basement for storage of valuable papers, books, records, etc.—simply **one** instance among thousands of the benefits derived from using CERESIT for making concrete, cement and stucco **permanently bone-dry.**

CERESIT Waterproofing Compound is a cream white plastic paste that readily mixes with the water used to temper cement and concrete. It absolutely does not retard hydration, thus insuring uniform distribution throughout the entire mass. CERESIT is unlike any other water-proofing. It was awarded **10 gold medals in 3 years**—thousands of installations throughout America, Europe, Asia and Africa testify to its exceptional merits.

Service to Architects—Our engineers—specialists of wide experience in all phases of waterproofing—co-operate with architects to secure sure and everlasting results. **Write us for literature and specific data.**

Ceresit Waterproofing Co., **983 Westminster Bldg., Chicago**

Turbine Pumps

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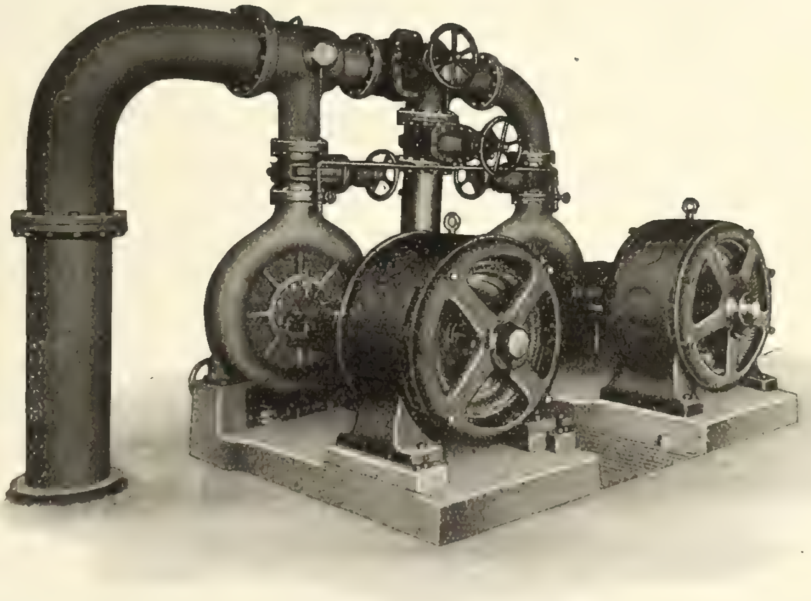
Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



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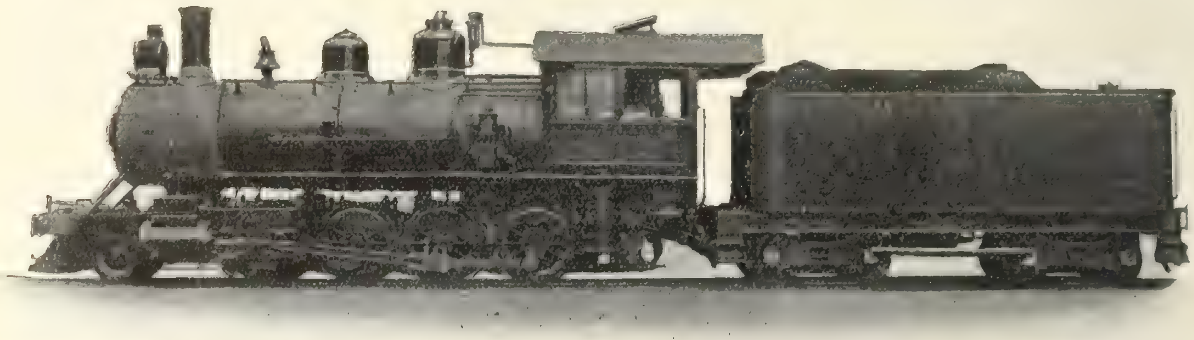
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Rebuilt Locomotives

sold by us give as long service, without repairs, as new ones.



The above photo will give you an idea of the class of equipment we handle.

Immediate shipment can be made on consolidation mogul, 10 wheel, switch and saddle tank locomotives.

If in the market for Dump Cars, Flat Cars, Passenger Coaches, Locomotives, Locomotive Cranes, in fact any kind of contractors' or railway equipment, write us for bulletins, photos, specifications and prices.

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ECONOMIZERS

Built for high pressures. Ground taper metal-to-metal joints.

Not a gasket throughout. No leaky joints.

Have been given preference repeatedly by prominent engineers for all the large power plant work where mechanical superiority counts.

GET CATALOG 150-Z

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Selling Agents for the
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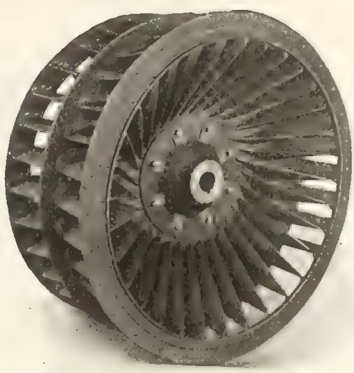
"THE RILEY STOKER"



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The opportunity for greater economy and efficiency in **Heating and Ventilating** is emphasized in the **"Keith" Fan.** Comparative tests of other types of fans have resulted in the **"Keith"** being proclaimed the most efficient and economical in the Fan World. Write for our New Catalogue No. 55.

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It is the only book on Electric Light and Power Wiring and Construction endorsed and recommended by every Board of Fire Underwriters in the United States and Canada, because it is the only one kept strictly up-to-date and revised every year in accordance with every rule and requirement of the

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"It settles disputes and, if referred to before wiring, prevents disputes."

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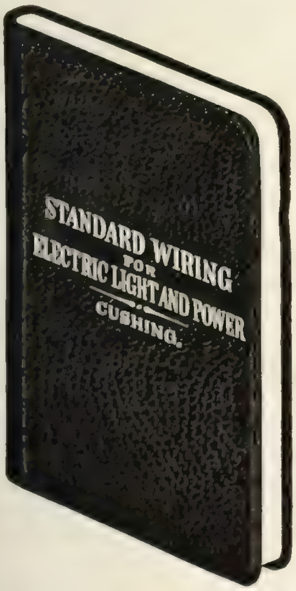

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

Fire Escapes
Manitoba Bridge & Iron Works
McGregor & McIntyre

Floor Hardener
Ceresit Waterproofing Co.

Force Cups
Can. Consolidated Rubber Co.

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Sturtevant Co. of Can., Ltd., B. F.

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Goold, Shapley & Muir Co.
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Pilkington Bros.
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Marsh & Henthorn
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Pawling & Harnischfeger

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Noble, C. W.
Pedlar People Limited
Steel & Radiation Ltd.
Trussed Concrete Steel Co.

Metallic Roofing
Pedlar People Limited

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Ford Meter Box Company

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(Continued on Page 14)

Easily Operated by One Man

THE G & G Telescopic Hoist Model A illustrated, makes it possible for one man unaided to perform the entire operation of raising ash cans to sidewalk and lowering empty cans to cellar.

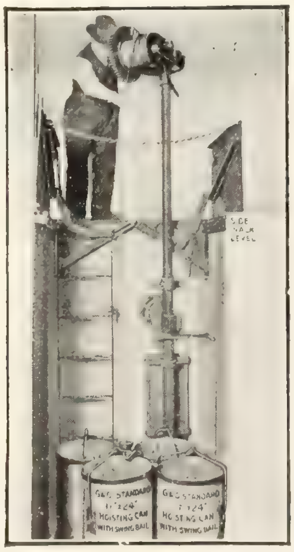

Illustration also shows the G & G Sidewalk Door Opening and Closing Device which automatically opens and closes doors as hoisting head is raised or telescoped.

The G&G PATENTED Telescopic Hoist with compound gear and brake attachment

Made in Canada

Raises a maximum load of 500 lbs. at a guaranteed speed of 30 feet per minute.

When not in use hoist telescopes and no part shows above street level.

It is fitted with a patented "silencer" that makes it practically noiseless in operation.

Operates from sidewalk level—protecting public from danger of unguarded open hatch and protecting operator from injury should anything fall into hatch.

Every hoist is subjected to thorough working test before shipment.

Write to our nearest agent for new booklet and prices

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A Complete Line of Road, Street and Contractors' Machinery

Champion Distributor

Champion Oil Distributors

A complete line of Oil Distributors for the applying of light Oils as dust preventatives, or the heavy Asphaltic or Tar Binders Especially designed; durable and adapted for blanket treatment or penetration method of distribution. Let us solve that road oiling problem for you!

THE DOMINION ROAD MACHINERY CO., LIMITED, Goderich, Ont.

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

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Hagersville - Ont.

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American Lead Pencil Company

Perforated Metals
Canada Wire & Iron Goods Co.

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Beatty & Sons, M.
Browning Company
Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Marsh & Henthorn, Limited

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Pittsburgh Valve, Foundry & Construction Company

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Iona Gypsum Company

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Canadian Ingersoll-Rand Co.

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Canadian Ingersoll-Rand Co.

Power Engines
Inglis Company, John

Pressed Brick
Interprovincial Brick Co.

Pump Valves
Can. Consolidated Rubber Co.

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Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
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De Laval Steam Turbine Co.
Hamilton Mfg. Co., Wm.
Hopkins & Co., F. H.
Inglis Company, John
Laurie Company, E.
McDougall Caledonian Iron Wks.
Morris Machine Works
Smart-Turner Machine Co.
Turbine Equipment Company

Pumping Plants
Rock & Power Machinery Co.

Quarry Machinery
Canadian Ingersoll-Rand Co.
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Goodwin, Barsby & Company

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Canada Wire & Iron Goods Co.
Dominion Iron & Steel Co.
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Steel & Radiation Ltd.
Trussed Concrete Steel Co.

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Morrison & Co., T. A.

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Can. Consolidated Rubber Co.

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Rogers Supply Company

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Dull Company, Raymond W.

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Can. Fairbanks-Morse Company
Taylor, J. & J.

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Can. Fairbanks-Morse Company

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Canada Wire & Iron Goods Co.
Dominion Road Machinery Co.
Dull Company, Raymond W.
Goodwin, Barsby & Company

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Britnell & Company
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Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
London Concrete Machinery Co.
National Iron Works
Ontario Sewer Pipe Co.
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Standard Clay Products Ltd.

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Bishopric Wall Board Co.

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Canadian Equipment Company
Hopkins & Co., F. H.
Montreal Locomotive Works

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Hope & Sons, Henry
Pedlar People Limited

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Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
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Made in Canada

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ARTIFICIAL MARBLE is polished (not varnished) in the same manner and with the same material as natural marble.

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We manufacture ARTIFICIAL MARBLE in all the beautiful colorings of the Italian, Greek, French and Belgian marbles, and the well known Canadian and American marbles, and our facilities are adequate to turn out the largest contracts.

Specify ARTIFICIAL MARBLE and avoid delays caused by the unsoundness of natural marble quarries.

Manufactured by

J. E. CARREAU

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Good Roads Making Good
by using

Dundas Stone

Best by Test

Canada Crushed Stone Corporation, Limited
DUNDAS, ONTARIO

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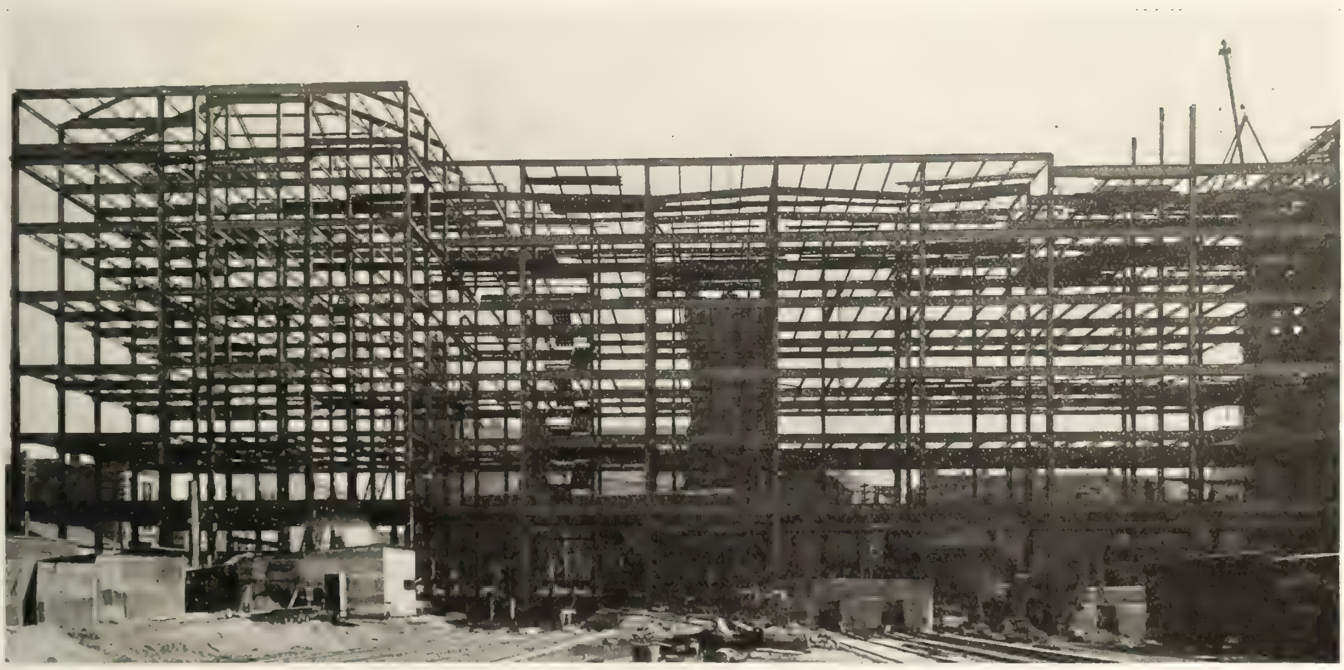

Section of Canadian Pacific Railway Terminals, TORONTO

Structural Steel painted with
"SUPERIOR GRAPHITE PAINT"

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Because Architects and Engineers know it's "A LITTLE BETTER"

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WALKERVILLE, ONT.

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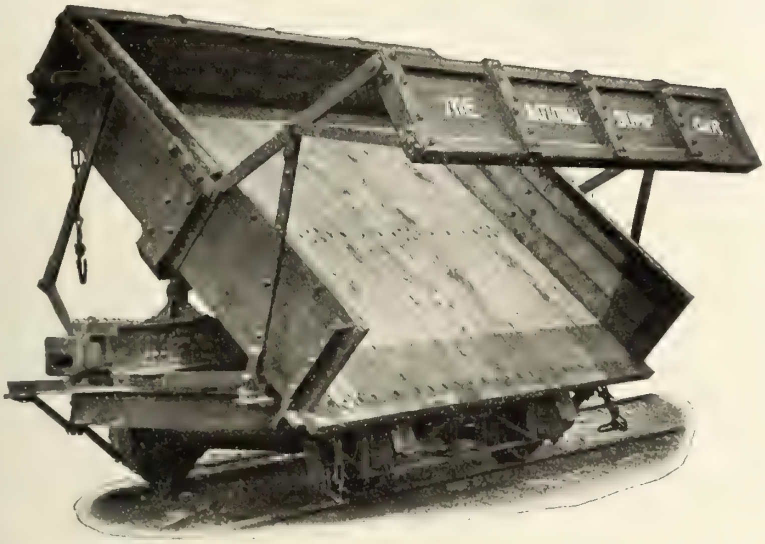

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—BUY NOW—

and keep the wheels of progress turning.

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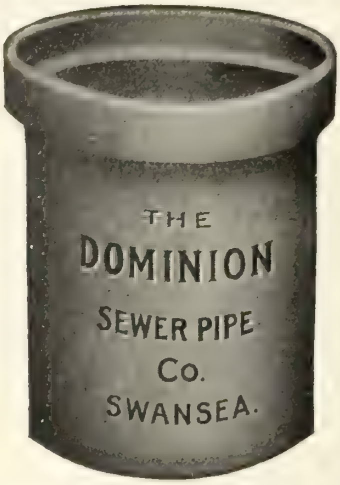
Salt Glazed and Vitrified

SEWER PIPES



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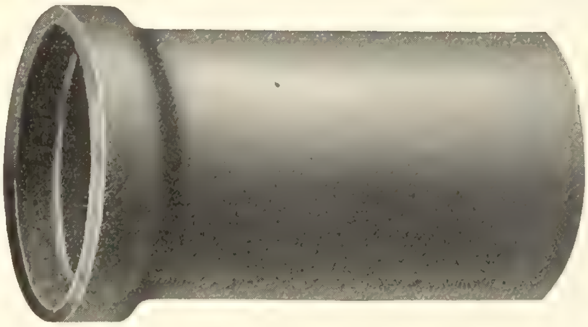

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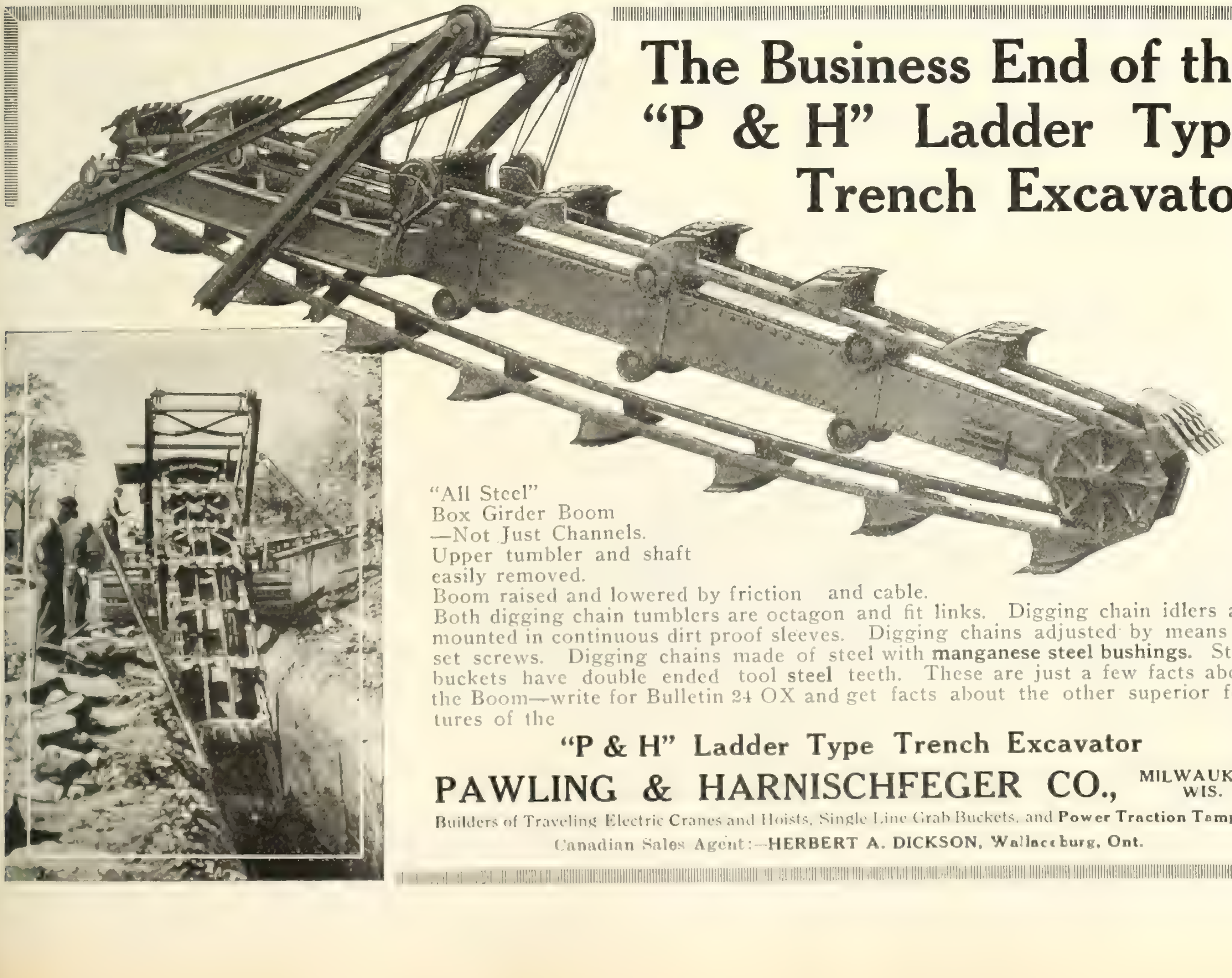
The Business End of the "P & H" Ladder Type Trench Excavator



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Upper tumbler and shaft easily removed.
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"P & H" Ladder Type Trench Excavator

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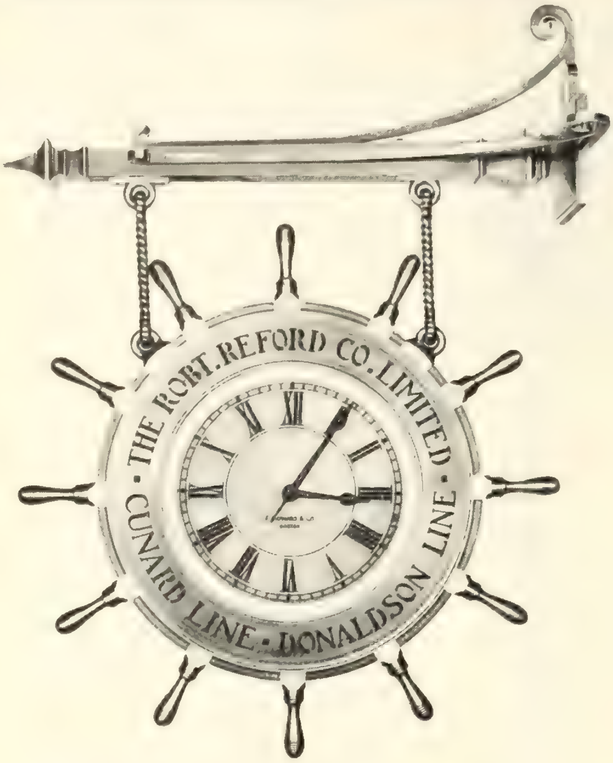

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This remarkably fine casting was manufactured in its entirety in our Montreal plant for the Robert Reford Co., Ltd., Montreal. The clock movement is of the electrical type, operated by a master clock inside the building, and the dial and lettering are illuminated by Mazda lamps and Holophane reflectors. Designed by Ross & Macdonald, Montreal.

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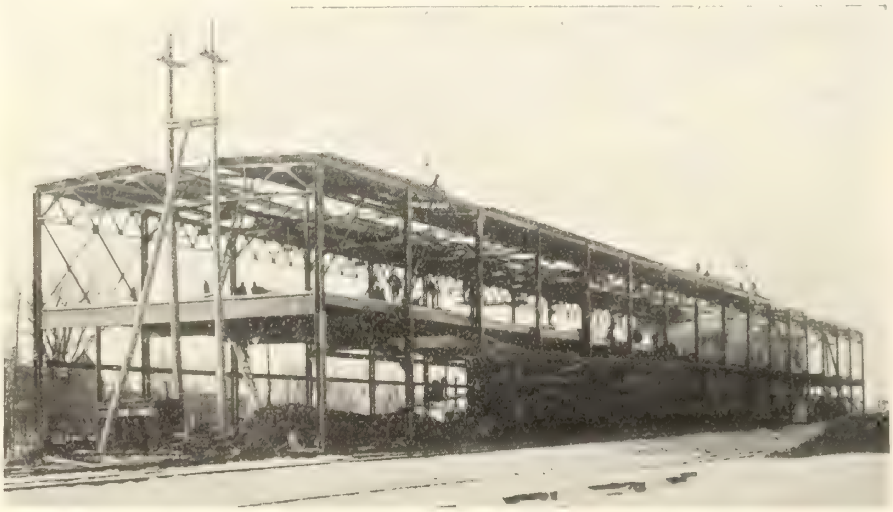

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ESTABLISHED 1886

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Ancient Cities with Ancient Methods

EVERYONE has heard of the king who went down into history as the man who "never said a foolish thing nor ever did a wise one." King Charles voiced praiseworthy sentiments, but never took part in putting them into effect.

Times change. Now it is not difficult to find men, and bodies of men, whose foolish actions are unredeemed by the saving grace of even word wisdom. Take for instance the Builders' Association of Quebec who recently passed a lengthy resolution protesting against the award of contracts to outside firms and expressing the hope that "Directors of banks, companies, and all other enterprises will strive in future to encourage Quebec contractors by preference." (A postscript is added to the effect that lists of general contractors and those engaged in the various trades can be obtained at the offices of the Association).

The only effect of resolutions of this kind is to attach to a community the stigma of insularity. The progress of Quebec City has been retarded and will be retarded, by just such methods. Dominated by such influences the "ancient capital" will remain the "ancient capital" until the crack of doom.

In such a day as the present when so little business is to be had, it is only fair that local contractors should have the preference, **other things being reasonably equal,** but every town or city or community that openly advocates a policy of exclusion is promoting something inimical both to national and private interests. If the business of the country is to be sustained, the towns, cities and communities of the country must work together and promote their business collectively. Scattered effort is lost in the attainment of national development.

It is to be hoped that by the time the city of Quebec is as old again she will have learned the wisdom of promoting competition at all sacrifice, just as her younger sister, Montreal, is beginning to profit by expensive experiences by no means far removed.

An Example to be Avoided—From Quebec

ON MORE than one occasion we have referred to the discourteous treatment—to use a mild expression—which contractors now and again receive at the hands of municipalities. The conditions under which they tender are sometimes unnecessarily severe and are only tolerated under stress of keen competition. Contractors are expected to live up to the strict letter of the specifications and conditions, while councils, in too many instances, act as of they were above the law, and if it suits them disregard the conditions which they have themselves drawn up. These conditions are set aside regardless of the hardships and expense to the contractors, and often it requires the intervention of the law to prevent injustice from being done. Members of councils will act in their public capacity in a way which they would repudiate as private citizens.

A flagrant example of unfair dealing with contractors has just occurred at Chambly Basin, P. Q., where the council advertised far and wide for tenders for sewer and sidewalk work. The invitation resulted in numerous bids being received, many of the firms being represented at the meeting at which the tenders were to have been opened. But a little surprise was in store for these firms. Before the tenders were considered, a Montreal contractor requested that the time for receiving tenders be extended, on the ground that he had only just learned of the work. There was a vigorous protest from the other representatives, who had complied with the advertisement. The Montreal man, however, was persistent. Then some local contractors, who of course could not plead ignorance of the date of closing, asked for permission to bid.

The lawyer of the council was consulted and advised that the members would be within their rights in postponing a decision on the tenders. The representatives of the firms who had tendered asked that, in this event, they be allowed to withdraw their offers, and to make new prices. This request was disregarded, and by the casting vote of the mayor it was agreed that the tenders be not opened on that occasion; that other firms be allowed to put in bids, and that all the bids be considered three days later.

The entire proceedings will, we think, strike most men as unbusinesslike, unfair and contrary to the spirit, if not to the actual letter, of the advertisement. A definite time for the closing of the tenders was fixed, and any contractor who was even a minute late was barred; yet we find the council deliberately breaking their own conditions, and allowing men who were cognisant of the date of closing, and who had neglected their opportunity, to enter the competition for the work. Even if they had the excuse of ignorance it was manifestly unjust to postpone a decision in order to allow them to tender. These late-comers had a possible advantage over those who complied with the conditions. Every tender had to be accompanied with a cheque of ten per cent. of the price, and it was possible that the amounts of these cheques might leak out, thus giving an approximate idea of the tenders. If such knowledge could be secured it is apparent that under-bidding by local men would be an easy matter. Even on the supposition that leakage was impossible, the occurrence of similar incidents is strongly to be deprecated as being irregular and prejudicial to the interests of contractors and councils.

Portable Houses for Europe

IF there is any truth in the report as to the impending orders for portable structures on a scale of millions of dollars, one of the most important industries identified with constructional operations will benefit materially and business throughout the whole field will receive a decided impetus. The report is that the British Government has been negotiating for the purchase of all kinds of portable structures to be taken to Northern France and Belgium to replace temporarily the dwellings, churches and schools which have been laid low in that ravaged territory. At the time of going to press a large Brooklyn firm has been mentioned in connection with one of the most important contracts which are to be awarded, but the requirements are on such a huge scale that Canada cannot fail to receive a share of the business and let us hope a considerably greater share of subsequent orders of the kind.

It is said that the contracts now pending include one for the construction of 20,000 portable houses—the largest single contract ever given for buildings of this type. Entire cities and towns are being created from them to house the refugees made homeless by the high tide of the German advance into France. The buildings are to be so constructed that they can be set up quickly upon their arrival in France. Shipment is to begin early in the fall if the contract goes through, and all the work is expected to be completed by the winter. The fact that such huge orders are in the air suggests that Canadian manufacturers should look into their resources and capabilities, and take enterprising measures to secure a share of the business.

There has been some criticism of the idea of placing such orders in the United States, but it devolves upon us first to show that we are capable of handling such business—and this we can do.

Enquiries made by our contemporary the Canada Lumberman would indicate that many Canadian plants are in an excellent position to meet the requirements of any such contracts and that a large number of factories having the best possible equipment for such work are not running at anything like their full capacity. Many of these quote close prices and give as good delivery as any United States plants. This claim was put forward very strongly in a letter to our contemporary. The Schultz Bros. Company, Limited, write:—"The manufacture of portable houses requires special manufacturing facilities and familiarity with technical details differing from those of ordinary building operations. There are plants in Canada which are able and ready to handle orders of this kind, and in our opinion the entire order in question could be conveniently handled within the required time.

"It seems to us that those mediums through which such orders are placed on behalf of the Imperial Government, should in the first place ascertain the ability and the capacity of Canadian plants before going to American concerns. Our Canadian Manufacturers' Association at the present moment could establish another field of activity besides those they so ably carry on, a sort of Clearing House for War Supplies, through which the various Canadian plants could establish their ability and capacity of handling war orders and through which the Government could ascertain what kind of orders our Canadian manufacturers could handle. For certainly our Canadian loyalty to the Empire entitles us to that consideration, the more especially as we should handle such orders not merely for the money consideration, but with that special attention which our patriotism and loyalty inspire. And such a clearing house would be free from baneful political influences."

The stand is well taken that Canadian firms have not been as wide-awake to their opportunities for war contracts as they should have been, and that energetic, concerted action on the part of the manufacturers will yet prove a most profitable business policy.

The famous Culebra Cut on the Panama Canal has been renamed "Gaillard Cut" by order of President Wilson, in honor of the late Lieut.-Col. D. D. Gaillard, Corps of Engineers, United States army. The President, in his order, says: "As a member of the Isthmian canal commission from March 16, 1907, to December 5, 1913, Lieut.-Col. Gaillard was in charge of the work in Culebra Cut until its virtual completion, being compelled to abandon his duties in July, 1913, through an illness which culminated in his death on December 5, 1913. His period of Panama canal service included the years of most active construction work. He brought to the service trained ability of the highest class, untiring zeal, and unswerving devotion to duty. I deem it a fitting recognition of Lieut.-Col. Gaillard's service to the country to rename in his honor the scene of his life's triumph."

Progress of Construction on the New Welland Ship Canal

INFORMATION covering the progress of construction on the new Welland Ship Canal to date has been furnished by Mr. J. L. Weller, the engineer in charge of this great undertaking. Dividing the work into four sections, in submitting his data Mr. Weller has described the progress on each section separately. Referring to section No. 1 Mr. Weller says:

The new harbor at the Lake Ontario entrance to the canal is now well under way. The entrance channel is being formed by the construction of two earth embankments that will extend one and one-half miles into the lake; these embankments have now reached a point about 5,000 feet from the shore line and contain approximately 1,800,000 cubic yards of material.

Fair progress is being made with dredging operations in the entrance channel, three dredges having been engaged at this work all last season, and the same number are at present employed, but owing to the hard nature of the underlyinb material progress is necessarily slow.

Concrete Cribs and Retaining Walls—Dry Excavation

The reinforced concrete cribs that will form the substructure of the entrance piers at the end of the embankments are being built at Port Dalhousie, the entrance to the present canal, 3 miles west of Port Weller. These cribs are 110 feet long, 38 feet wide, and 34 feet high, and 53 of them will be required for the entrance piers and the docking in the harbor. One crib was constructed last season and three more have been completed so far this year. The contractors expect to build about 18 of these cribs during the present season.

The construction of the reinforced concrete retaining wall, which will extend along the west side of the harbor for 2,000 feet, is nearing completion. The contractors are at present engaged in building the west lock wall of Lock No. 1, and concreting on this structure has been rapid during the past few months. The standard lock wall is a mass concrete structure 81 feet 6 inches in height and 46 feet wide at base.

The dry excavation on section No. 1 is practically completed, the material having all been disposed of in the east harbor fill. A good deal of the excavating plant has been rented to the contractors for section No. 2, who are disposing of their excavated material in the west harbor embankment, and a cross-over is at present being constructed to enable these contractors to dump on the east side of the harbor.

The upper-entrance walls to Lock No. 1 will be built upon a timber-pile foundation, the piles for which have all been driven.

Breast Wall for Section 2

The work on section No. 2 during the present season, outside of ordinary dry excavation, has consisted of the construction of the breast wall at the head of Lock No. 2. The pit for this wall was taken down 69 feet to rock, states Mr. Weller, who thus described the methods employed:

The method of excavation adopted was to drive steel sheet piling to refusal and excavate material to the bottom of the piling, after which piling was re-driven and the material excavated to rock. Concreting on this wall is now up to ground level, and the remaining 6 feet will be completed soon. The upper entrance walls to Lock No. 2 will also be built on a pile foundation, the piling for which has been driven and the seat prepared, and concreting in the west-entrance wall is now under way.

The contractors for this section have removed approximately 2,500,000 cubic yards of earth excavation during the past year, the bulk of it being disposed of in the harbor embankments.

The next structure to be started will be the breast wall of Lock 3, and the method of construction will be similar to that employed at Nock No. 2.

Some work has been done on concrete protection to banks, this consisting of a 6-inch slab of concrete laid upon 8 inches of broken stone, and extending 5 feet below and 5 feet above the water line, the base of this concrete protection resting on a 5-foot berm in the canal bank.

Mr. J. L. Weller, Chief Engineer, Welland Canal System.

Rock-Crushing Plant for Section 3

Section No. 3 comprises the flight locks Nos. 4, 5, and 6, in pairs, single Lock No. 7, and two diversions of the Grand Trunk Railway. These railway diversions have been completed, and the contractors are making good progress now with rock excavation on the site of the twin locks. This work involves the excavation of solid rock to a depth of approximately 80 feet for Twin Locks 4 and 5 and single Lock No. 7. There are five steam shovels engaged in this work at present and a number of electric drilling machines, and material is being removed at the rate of about 75,000 cubic yards per month.

Of the rock-crushing plant Mr. Weller says:

All of the good rock excavated is being crushed for concrete, the contractors having been obliged, under their agreement, to erect a rock-crushing plant with a capacity of 4,000 tons a day. This plant has been in operation for some months, and stone for concrete is now being supplied to the contractors for sections Nos. 1 and 2. The dam at the head of Lock No. 6 is progressing satisfactorily, two dragline machines being engaged in rehandling material from storage piles, either side, into the dam, and the material is being compacted by steam rollers. The dam is now built up to a height of about 15 feet above the natural ground level. The upper west entrance wall to Lock No. 6, which was started during the fall of 1914, has been completed.

Pile driving is now being carried on for the east entrance wall of Lock 6, and concreting in this wall will be started within a short time.

Work on section No. 4, which consists of widening and deepening the present canal, is progressing rapidly, five steam shovels being employed in the dry excavation to widen the present canal banks, and to June 1, 1,250,000 cubic yards of material have been removed and disposed of on the low land to the west of the present canal. No further sections have been placed under contract to date.

A construction railway to haul excavated material to the dump in the lake and crushed stone from the crushing plant on section 3 is completed, with interlocking and block signal system, telephone dispatching, etc., and is being operated at present to almost its full capacity.

Mr. Weller believes the $50,000,000 waterway will be ready to open in 1918. While the war has had the effect of delaying the letting of some of the contracts, in other particulars the progress made so far is entirely satisfactory to him.

New Methods Evolved in Building World's Largest Bridge*

Quebec Erection Takes Care of Members Spliced Between Panel Points by "Flying Falsework" and Erection Trusses—Travelers Unique for Size and Central Operating Control

REMARKABLE erection problems solved by unique and effective methods characterize at every turn the greatest bridge building undertaking that has ever been attempted. The main members of the Quebec bridge are so huge that most of them have to be spliced between panel points, and these spliced halves further split lengthwise into two and even four parts for shipment and erection. The field work of fitting these parts together was only made possible by shop work of unprecedented accuracy. This splicing also made necessary extraordinary means of support between panel points for many of these members during erection.

A vertical hoisting range of 320 feet was required of the erection tools, within which height 90-ton members must not only be handled, but handled in pairs, and with speed and accuracy. The size and weight of the trusses made it desirable to have erection progress on both sides of the bridge exactly simultaneous. This condition has been met and turned to positive advantage.

To deliver material to the piers at the river's edge for simultaneous erection of the anchor and channel arms would have required expensive trestles and a double outlay for erection plant. On the other hand, to erect the anchor arms first has required heavy falsework, some of which at least must remain in place until the river work is well along, since the top chords of the bridge are tension members, and the stress in them could not be reversed without going to great expense in their construction.

Order of Erection on Anchor Arm.

The floor system of the north anchor arm was erected on interior falsework consisting of steel towers, topped by heavy plate girders on which the floorbeams of the bridge rest directly. The traveler, running on outside tracks on this floor system, completed this operation from abutment to pier. It then moved back, setting steel columns at each panel point under each truss and erecting the bottom chord as it went. It next traveled back to the pier, the move being made in a few hours, and began erecting each truss to the subpanel points above the floor system. The floorbeams were then connected to the trusses and no longer required the support of the first set of staging. The traveler then erected the upper part of the trusses, completing the span as it moved out for the last time. The falsework that had carried the floor system was removed behind it. This was promptly shipped across the river and re-erected under the south traveler, which had just been set on the south abutment.

The bank on the south side is higher than that under the north anchor arm, but the steel towers of the falsework were designed so that a section unbolted and removed from each left them the proper length for their new positions. This interior falsework weighs 2,500 tons, while the outer towers under the panel points, which must remain in place until the river arm is erected, and which alone had to be duplicated for the south anchor arm, weigh but 500 tons.

Tower Travelers Equipped With Cranes and Booms.

The 1,000-ton travelers that are handling this erection are themselves without precedent in design and operation. The main bridge tracks are left clear for steel delivery, and additional girders outside them carry the traveler tracks. A square steel tower, comparable in height and weight of members, is surmounted by a trussed bridge, overhanging either side of the tower parallel to the main trusses. On top of this bridge are two traveling cranes, each crane carrying two hoisting machines. These main hoists are mounted back to back on the crane girders, and each operates a ten-part fall. In order to keep the heavy machines as near the centre of the bridge as possible, the hoisting cables are led over sheaves mounted on trolleys connected to the main hoists and moving with them. An auxiliary crane is mounted on the outer end of each of the main cranes. These auxiliaries are moved by hand power, but are provided with power hoists. They handle pin-driving cages, riveting platforms and light loads.

In addition a steel boom is mounted half way up each corner post, each boom swinging by power through 270 deg. The four hoists controlling these booms are banked on the operating deck, over the tracks, on the land side of the traveler. Just under them is the transformer house—for the sole power used for all the erection is electricity from neighboring power developments. At the front of the operating deck is a bridge from which all sides of the traveler are visible. Here are the controls for operating the cranes on top. The motors for the hoisting and traveling motions, however, are mounted on the cranes above, and draw current from a multiple-unit contact system on the deck of the top bridge. A man is stationed at each hoist, with a telephone to the control deck at his elbow in case of accident. An electric elevator connects the crane deck with the operating deck. The traveler is mounted on four trucks provided with eight wheels each, and is moved by two sets of wire-rope falls, to which two of the derrick falls are luffed for pulling.

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*Abstract of progress report by The Engineering Record.

With this traveler it is possible to set the corresponding members of each cantilever truss at one operation. The members are loaded each on two short, heavy lorry cars, and pushed out to the bridge head side by side on the main tracks by dinkeys. The front crane is spotted, and its trolleys are run in to the sides of traveler.

A two-part fleeting tackle is hooked into two open-sheave blocks on the inside of the lifting beams on each set of falls from this forward crane. This fleeting tackle draws in the opposite blocks of the crane to the main tracks. The open-sheave blocks are mounted on a centre strap, and the fleeting tackle, consisting of a single long sling of wire rope, needs only to have the bights of each part thrown behind the sheaves to engage the blocks. The two ends of the sling, which are on top, are then picked up by one of the forward booms, drawing the main falls in over the track until they can be hooked up to the forward ends of the members to be set. The ends of these members are then raised, and the crane which has hold of them is moved forward.

Meanwhile the derrick holding the fleeting tackle booms out and picks up its load, and the dinkeys push out the rear ends of the two members, which still rest on the rear lorry cars. When the back hitching point of these members comes in front of the traveler tower, where the rear crane can reach it, the falls of this crane are fleeted in by the other forward boom and attached. The members are then raised clear and the cranes run out in position to set them, one raising its ends as the other lowers until the members reach the proper inclination for entering. The fleeting tackles are slacked as soon as the members are in the clear, and are cast off by four men, one of whom rides each lifting beam, by throwing the bights of the slings out of the open sheaves. The members are then lowered or raised to place and connected. With the centralized control of the traveler it is possible to move the cranes and booms together as if they were interlocked, with little signalling and a minimum expense of lung power. The two 73-ton inner halves of the upper half of the lower subdiagonal in the cantilever panel next the north pier were set in this manner inside of forty minutes.

Two general types of lifting hitch are used. They bushed in a large pin-hole of a member, while in the other the lifting pin passes through holes in special are identical, except that in one the lifting pin is lifting angles bolted to the back of the member.

"Flying Falsework."

The vertical tension members from the subpanel points to the bottom chord are erected after all the diagonals for the panel are in place. To make the pins in these posts, as well as to support the bottom-chord members until they are placed, some kind of falsework from which to jack was practically necessary. Such falsework was also required for another reason. The four parts of each bottom-chord section, spliced in the centre, must be erected and matched up on something solid in order to obtain workable results.

A lattice truss, lying flat in the plane of the bottom chord, with a set of heavy girders under each chord member, was devised for this service. Its rear end is supported from the pier for the first panel, and hung from the last bottom-chord panel-points for the rest of the erection. Each side of its "flying" end is hung by two ties, each consisting of one long and several short pairs of eyebars from the last subpanel points erected. The length of these ties is adjusted for each succeeding panel by means of the short eyebars at their lower ends.

On top of the girders of this truss, under the splice and under the outer end of each bottom-chord sections, are set four 100-ton hydraulic jacks to make the necessary adjustment. This bridge is raised by the main traveler by means of two pairs of lifting angles, and can be slid forward one panel and reset in a minimum of time.

The lower diagonal members are erected after the first half of the bottom-chord, which is the first member set in each panel. They are supported by guy tackles of wire rope attached to the subpanel points last erected. These tackles are pulled to the required tension by the derrick booms and clamped off with heavy, copper-lined eight-bolt cable clamps before the lifting tackles are loosened. They provide ready adjustment in making the pin connections with the other members meeting at the subpanel point. The outer ends of the bottom-chord members are next set. Then the remaining diagonals of the panel are erected. After the lower vertical members have been placed the upper posts are set, and last the top-chord members are placed. This chord is composed of two lengths and two banks of eyebars. To support the centre pin during erection each panel length is packed inside a light riveted truss, which spans the panel, but takes no stress as a member of the bridge. The eyebars are packed in these trusses in the bridge yard, and hauled to the traveler and erected as a unit.

Safety Provisions Necessary for Rapid Erection.

Pin-driving cages, provided with chain blocks for raising and inserting the pins, and holding the ram, are handled by the auxiliary cranes. These cranes also handle the riveting stages. A small electric winch mounted on the top of each main post drags a traveling riveting platform up each chord from panel point to panel point. These two platforms are connected by an ample runway with handrails carried on the top ties between the main trusses. Ample and solid stairways and wide, safe platforms are provided everywhere. Electric elevators are also installed to connect the track level with the ground at each abutment.

As a result of these provisions the men do not have their energies dissipated by holding to precarious perches while trying to work, and are able to get from point to point on the trusses without tiring themselves out in order to get to their work. Attention to these points would, it is believed, pay on any erection, but on a bridge of this size this is essential to progress. The cantilever arms of the bridge must be riveted practically as fast as they are erected, not only for safety, but because erection stresses would displace any riveted connections left drifted or bolted in the ordinary way and make it impossible to rivet them later. On the speed of this work, therefore, hangs the whole erection progress and everything is done to facilitate the riveting.

Good Shop Work Helps Erection.

The shop work on these large members is of the finest and the money spent on it has made erection accurate and easy. Although the fact is so incredible that the engineers are loth to be quoted about it, it is a matter of common knowledge at the bridge that the top pins of the main north posts, which are 310 feet high, and contain six splices, were erected within 0.002 feet of their calculated elevation for the prevailing weather conditions. Precise checks only confirmed the accuracy of the first measurement.

The north anchor arm has been erected and the north cantilever begun. It and the south anchor arm will doubtless be finished this season, as from 600 to 800 tons a day are being erected by each traveler. The north traveler next year can erect the suspended span. For this purpose its tower will be shortened by taking out two of the panels. The suspended span will be erected on towers, over the water at high tide, but on ground which is bare at low tide. The concrete footings for this falsework are now being placed. Meanwhile the south traveler can erect the south cantilever. The suspended span will then be floated into place and connected at the ends of the cantilever arms. There is nothing to prevent carrying out this program, as fabrication is well advanced. The steel for the north cantilever is practically all at the site, as is that for the south anchor arm, and also some of that for the south cantilever.

Yards Equipped With 90-Ton Cranes

The steel is unloaded by the yard cranes and locomotive cranes in a large yard on each bank of the river, back of the approach tracks to the bridge. Here it is sorted and stacked and the top chords and lighter long diagonals, shipped in section, are fitted together by the 90-ton traveling yard cranes. Members are loaded up on lorry cars as wanted and hauled to the bridge-head.

The personnel assembled by the erection of this bridge includes Mr. C. N. Monserrat, Chairman and Chief Engineer of the Board of Engineers, Quebec Bridge; Mr. Ralph Modjeski, and Mr. C. C. Schneider, consulting engineer to the board, and Mr. H. P. Borden, assistant to the chief engineer. Mr. J. D. Wilkens is in charge of erection for the board as resident engineer at the bridge. With the St. Lawrence Bridge Company, which has the contract for the fabrication and erection of the steel, is associated Mr. S. P. Mitchell as consulting engineer. George F. Porter is erection engineer for the contractor, while Mr. William Fortune is in charge of all erection as superintendent.

The relative merits of cast iron and vitrified stoneware pipes for house sewer drains has been exhaustively investigated for a year by Mr. A. C. Shaver, Chief Sanitary Inspector of the City Government of Pasadena, Cal. The judgment of that body on their officer's report is in favor of the cast iron pipe, and they have made an order that in future that pipe alone shall be employed in their area. The conclusion arrived at is that cast iron pipes can be made root-proof at the joints and can be thrown out of alignment without breaking, whilst the slightly higher initial cost does not justify the risk of having to tear up the entire sewer to clean it.

More Steel in Bridges

PRESENT low steel prices emphasize and reinforce a movement that has been going on steadily for some years past. Structural design in times gone by had as its ideal the production of structures of minimum quantity of steel. Excellence of general design, soundness of details and resistance to the various attacks of time were neglected elements in comparison with the matter of satisfying certain computed stresses by the fewest pounds of steel. We are in a period of reaction from this school of design. The movement is toward heavier, more substantial design.

Sound designing is not a mere problem of arithmetic, in engineering any more than in architecture. There are many factors vital to the finished structure which do not appear in the force polygon. To take them into proper account calls for a well-ripened judgment; their requirements will often conflict, and the solution must be a compromise.

Let an instance of this be taken in the old and yet obscure conflict between flexibility and rigidity of structure. In past times this was responsible for the existence of two different groups of designers—one aiming to cushion impact and damp out vibration by building resilient structures, the other holding to the view that the most rigid and solid support, a rocklike absence of all yielding quality, is the ideal structural condition. The opposition between these views still exists in part, but we have progressed a little ,and know that both views are partly right. What we seek therefore to produce to-day is an aggregate that contains both rigid and yielding elements, providing flexibility where primary impact is received or where other secondary effects of unmanageable character occur—as expansion or distortion—and, on the other hand, providing a highly rigid construction in the main frame.

This instance well exemplifies how the non-calculable elements of design must be handled on the basis of experience which develops from thorough intimate study of structure, service and material. All the workings of this judgment from experience, however, lie beyond the field of mere sectional-area computations, and may lead to conclusions which seem to violate the requirements of close economy of metal.

Let the inquirer into this subject note the contrast between modern and old-time ideas of good design as expressed in pounds of metal, where a bridge, say, 25 years of age is renewed. He will see, frequently, that the weight of the new structure is four times that of the old one, though designed for not more than twice its load capacity. The excess represents partly insurance, partly a commutation of maintenance expense.

Useful data will be added to this phase of the subject when a railway man takes the trouble to cast up and publish the record of maintenance and repair expense on an old-time bridge which was finally condemned and renewed. Such a record will be certain to form a convincing argument in favor of "ample" design and against the practice of seeking the lightest possible solution of the stress-sheet.—Engineering News.

The Ultimate Economy of Permanent Concrete Paving

Contributed by C. A. P. Turner, of Minneapolis

As one travels in various parts of the country, and is taken about by automobile over country roads and macadam, concrete or tar macadam pavements in different sections of North America, one cannot help being impressed by the rapidly growing introduction of concrete in road building. The cost of a good concrete paving, six to seven inches thick, is little in excess of the cost of building a macadam road. The difference in wear renders the concrete far cheaper than the macadam because the concrete is made in the proper proportions, and suitable aggregate is used, and it does not disintegrate, although it does check and crack where the foundation is unstable. As compared with tar or asphalt macadam it is generally cheaper, and unless the latter is made of better materials and in a more satisfactory manner than ordinarily executed, it will disintegrate in the severe climate where the concrete remains uninjured.

A number of miles of tar macadam were put in a year ago on the Superior Boulevard, between the city of Minneapolis and Wayzetta. Last winter's frost has left this paving in very bad condition, while the concrete paving which occupies a section of this boulevard of eight or ten miles, is practically uninjured, with the exception of a few minor defects. A large section of this boulevard is new ground, some of it filled and some of it in cut. The frost has in a few sections split the concrete paving by motion, upheaval and movement of the foundation. This could have been remedied very readily by a small amount of metal reinforcing to tie the work together.

Expansion joints the writer noticed in driving over sections of this paving would seem to offer opportunity for improvement. Where the paving is cut through in a few places where it has been heaved by the frost, longitudinal reinforcement passing through this joint and filling this joint with asphalt mastic would apparently have remedied this difficulty. In making a joint in this manner it would be desirable to dip or heavily coat the ends of the rods projecting into one section, so that the flow of pitch or asphalt would permit the rod to work and still hold the slab at its proper elevation.

The writer's observations of the concrete laid in the city of Calgary were decidedly favorable. The paving company had secured good aggregate and executed their work very creditably.

In Sioux City, Iowa, there are many miles of excellent concrete paving put in at a cost far below that of other materials and at a cost little in excess of the temporary macadam paving. The reason why a good concrete slab paving can be put down on a county road at little expense in cost over macadam lies in the fact that the slab covers the foundation, prevents the water from working into it and undermining the slab to a large extent, and in this way renders the task of getting a good foundation for the road a much less expensive matter. This is because the slab will give service on a foundation that the macadam paving of crushed stone would not remain in shape upon, because the crushed stone would sink into a foundation which would very satisfactorily support a concrete slab. The cost of this foundation is high for a macadam pavement and low for a concrete road bed.

It may not be amiss to call attention pointedly to the necessity of securing a sound, hard stone as aggregate for the concrete and good clean sand, particularly in our northern climate. If the stone is such that it absorbs water very readily and is disintegrated thereafter by frost, the concrete will not be permanent, and will be affected by the frost and disintegrate more or less rapidly. Clay in the sand will prove a source of disintegration just as surely as improper stone for the aggregate.

In many sections the cost of lumber for bridge floors and frequent renewals is causing bridge commissioners to demand something more permanent in the way of a floor. The writer met this demand many years ago by applying a six-inch concrete slab well reinforced, covered with about a quarter-inch coat of hot pitch and sand. On country bridges this is found to work very well indeed, and to protect the concrete from abrasion and frost. The coating is comparatively inexpensive, and may be used advantageously as a top coating for county roads.

Mr. C. A. P. Turner.

While there is probably little that is new in this brief statement, the writer has seen much money wasted in macadam roads when a permanent concrete paving could have been put down at almost the same first cost, and would have been comparably cheaper to maintain. Every good piece of highway which is constructed, the maintenance of which will be inexpensive, is a distinct gain to the public at large. Calling attention to economic methods of accomplishing this result, and pointing out the best material for the purpose is a service which your journal may render.

Tools, pails, etc., that have become thickly coated with concrete can be cleaned by heating. A gasoline torch will aid in removing concrete from mixers and other large equipment.

The Construction and Maintenance of New York State Highways

A Review of the 1915 Report of the Advisory Board on Highways to the New York State Department of Efficiency and Economy

Specially Contributed by Arthur H. Blanchard, M. Can. Soc. C. E.[*]

DURING 1913 and 1914 Mr. Prevost Hubbard, Chemical Engineer in Charge of the Division of Roads and Pavements of the Institute of Industrial Research, Washington, and the writer, served as members of the Advisory Board of Highways of the New York State Department of Efficiency and Economy. Various problems, relative to the organization, administration, specifications, construction and maintenance of highways and related activities of the New York State Highway Department, were referred to this Board from time to time during the two years it was in office, by the Commissioner of Efficiency and Economy, the Hon. John H. Delaney. At the request of the Commissioner, the Board collated its numerous reports and presented the final report referred to in the title of this article. The following resume will deal primarily with problems of interest to engineers of construction and contractors. All recommendations embodied in the report were the result of exhaustive investigations of the headquarters office in Albany, the nine division offices of the Division offices of the Division Engineers and the design, construction and maintenance of highways throughout the State.

Professor Blanchard

Organization.—The important recommendations with reference to the organization of the New York State Highway Department are as follows:

That the Commissioner of Highways shall be a civil engineer having had responsible charge of the construction and maintenance of highways for at least five years and who is a full member or has fulfilled the requirements for the grade of full member of the American Society of Civil Engineers (M. Am. Soc. C. E.).

That the Commissioner of Highways shall appoint three Deputy Engineers and twelve Division Engineers, each of whom shall be a civil engineer having had responsible charge of the construction and maintenance of highways for at least three years, and who is a full member or who has fulfilled the requirements for the grade of full member of the American Society of Civil Engineers. Each of the Deputies shall have charge, under the direction of the Commissioner of Highways, of all work in four Divisions. The Division Engineers will report in the organization recommended to one of the Deputy Engineers. In each Division there shall be engineers in charge of counties reporting to the Division Engineer. Each Division Engineer shall in his Division and each County Engineer shall in his County have charge of the construction and maintenance of all state and county highways and all state work relating to town highways and bridges.

Comprehensive Advertisements Necessary to Secure Competition in Bidding.—A very general criticism may be made regarding the method of advertising contracts by the Highway Commission, which has invariably resulted in giving incomplete information to prospective bidders, and, in certain cases, misleading information. It is well known that the object of advertisements is to secure as comprehensive competition as practicable from responsible contractors, hence it follows that the information conveyed in advertisements should be such as not only to attract the attention of such bidders, but also give them such information as will enable them to decide whether or not it will be worth their while to submit bids. Concise advertisements containing the character of information referred to above in many cases saves considerable correspondence and tends to reduce the process of the submission of bids to the most economical and efficient basis from the standpoint of all interested parties. The essential data to be included in advertisements of highway work in New York could be arranged in the form of a table with the following headings: road number, division, county, town, name of highway, approximate length in miles, square yards of road or pavement, class of work, guarantee, date of completion.

Preliminary Investigations Necessary to Determine Suitable Types of Roads and Pavements.—Because of the following reasons the design of many state and county highways in New York State during 1913 and 1914 has been both inefficient and uneconomical.

First, the comparatively infinitesimal amount of investigation which has been considered necessary as preliminary to the design of a given highway.

Second, failure to utilize readily available data, such as traffic censi, statistics relative to motor traffic registration in incorporated villages and cities, routes of motor buses at present operated, population statiscics and data of a similar nature.

Seventh, failure to compile and make accessible for reference all important details which constitute the history of highways constructed.

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[*] Professor in Charge of the Graduate Course in Highway Engineering, Columbia University, and Consulting Highway Engineer, New York City.

Fourth, the general meagreness of detailed knowledge of the many different materials on the market, and the varied methods in connection with which they may be used.

Fifth, belief by many highway officials and engineers in a panacea for the treatment of all classes of highways.

Sixth, a confusion of ideas on the part of many of the officials and engineers of the Highway Department as to the reasons for the success or failure of a given type of road or pavement.

Seventh, nonobservance of the relationship between the adaptability of various methods and materials, the variability in the cost of labor and materials, and the accessibility of new materials and machines.

Eighth, low ideals possessed by many of the engineers of the Highway Department as to the character of work which should be secured, which has resulted from past acceptance of inferior work and from lack of opportunity to become familiar with work of high grade in different parts of the State and other localities.

Width of Roadway.—In view of the fact that the unit width of traffic lines should be considered as nine or ten feet, and because the important trunk highways of New York are subjected to a rapidly developing traffic of motor trucks and motorbuses, it was recommended that the Commissioner of Highways should be given authority to construct many of the trunk highways with improved roadway surfaces of 20 feet in width instead of being limited to a maximum width of 16 feet.

Specifications.—Early in its work in 1913 the Board was directed to review the contracts and specifications of several lettings. As indicating the pitfalls which may prevail in specifications, the reasons for the recommendations to cancel many contracts are herewith cited: (1) materials specified distinctly different in type and grade from those advertised; (2) specifications which unnecessarily limited competition; (3) monopolistic specifications substituted for more open specifications which were indicated in the advertisement; (4) acceptance by the Highway Commission of bids on material other than specified; (5) bids requested on certain items which were so indefinite that an intelligent bid could not be made without knowledge ogtained from the Highway Department; (6) conflicting requirements in different parts of the same specifications; (7) different specifications for the same contract submitted to various bidders; (8) acceptance by the Highway Commission of altered bids; (9) duplication of work covered by different items upon which separate bids were requested; (10) inherently faulty specifications.

The revelation of the defects in the specifications resulted in a weeding out of certain inefficient employees of the Highway Department, the inauguration of more rigid supervision and more efficient methods pertaining to the draughting of modified specifications and finally an appreciation by the Highway Commission that the writing of an entirely new set of specifications was imperative if contractors were to be fairly treated and the interests of the State conserved.

During 1913 and 1914 the Board was requested to draft specifications for types of pavements suitable for use on state and county highways and to submit criticisms of specifications in current use by the Highway Department. The Board, recognizing the rapid increase in all classes of traffic on state and county highways and that the funds to be used were derived from the sale of fifty year bonds, recommended the use of cement concrete foundations for the four types of pavements to be used on properly designated state and county highways. Under the conditions existing in New York State in 1913 the Board recommended the use of the following types of pavement for the highways noted: bituminous concrete pavement with an aggregate of broken stone ranging from ⅛ to 1¼ ins. in dimensions; Topeka bituminous concrete pavement; brick pavement; and stone block pavement.

red pertaining to the relative merits of alternate type specifications and blanket specifications for bituminous materials. Although the chemists of the Highway

During the drafting of new specifications for the Highway Department considerable discussion occur-

Department recognized the value of separate specifications for refined coal tar and refined water gas tar, they were averse to the use of separate specifications covering the various types of asphalts secured from various sources and manufactured by several different processes. The Board pointed out that the individual tests required for specifications for individual materials may serve one or more of the following purposes: (1) they may directly indicate the suitability for a given use of the material specified; (2) they may serve as a means of identifying the source of a material or even the material itself; (3) they may serve to control uniformity in the preparation or manufacture of a material. It seemed apparent to the Board that tests used in selecting or specifying a material for a given use are most efficient when the test limits adopted specifically define a material and when such material has previously proved satisfactory for a particular purpose. It seems evident that the narrow test limits permitted in alternate type specifications allow the fulfilment of the essential requisites of specifications for bituminous materials in the most efficient manner.

Construction.—New York State built during 1913 and 1914 many miles of bituminous pavements constructed by the penetration method. The surfaces of many of these pavements showed waves or ruts soon after being opened to traffic. The Board believes that one of the inherent causes for these conditions is the light rolling required prior to the application of bituminous material. The usual method of rolling consisted in shaping up the broken stone course by one passage of the roller over the surface. It is impossible to secure inherent stability unless the broken stones of the course are thoroughly compacted and keyed together prior to the application of the bituminous material. During 1913 and 1914 many bituminous pavements of this type were poorly constructed due to the inefficient distribution of the bituminous material. The Highway Department specifications required the use of an approved distributor. Contractors, however, found it impracticable to secure a description of an "improved distributor." The Board, therefore, submitted the following specification:

The pressure distributor employed shall be so designed and operated as to distribute the asphalt, cement or refined tar specified uniformly under a pressure of not less than twenty (20) pounds nor more than seventy-five (75) pounds per square inch in the amount and between the limits of temperature specified. It shall be supplied with an accurate stationary thermometer in the tank containing the asphalt cement or refined tar and with an accurate pressure gauge so located as to be easily observed by the Engineer while walking beside the distributor. It shall be so operated that, at the termination of each run, the asphalt cement or refined tar will be at once shut off. It shall be so designed that the normal width of application shall be not less than six (6) feet and so that it will be possible on either side of the machine to apply widths of not more than two (2) feet. The distributor shall be provided with wheels having tires each of which shall not be less than eighteen (18) inches in width, and allowed maximum pressure per square inch of tire being dependent upon the following relationship between the aforesaid pressure and the diameter of the wheel; for a two (2) foot diameter wheel, two hundred and fifty (250) pounds shall be the maximum pressure per linear inch of width of tire per wheel, an additional pressure of twenty (20) pounds per inch being allowed for each additional three (3) inches in diameter.

Inspection. Especially during 1913 poor results due to inefficient inspection were apparent on every hand. Inspectors without previous training on the class of work of which they had responsible charge were employed in many instances. The 1913-1914 Highway Law was in part responsible for this condition as it required that inspectors of construction should be residents of the county in which the highway to be constructed was located. Such resident qualifications serve no useful purpose and tend to handicap efficient and economical work.

Maintenance.—Among the several details of maintenance of state and county highways which were covered in the Report may be mentioned the opinions of the Board relative to the use of "cold oil" and "hot oil" for surface treatments. Based on the conditions of use in New York, it was the conclusion of the Board that such products when used in the manner described were not suitable for economical maintenance and repair for the following reasons: (1) oils which meet these specifications require considerable time in which to set up, when used in the manner specified; (2) all petroleum products, while in a fluid state, act to a certain extent as lubricants, when used as specified; (3) it is therefore evident that more or less movement of the road surface will take place under traffic during the setting-up period; (4) the bituminous mats or carpets formed invariably become wavy and full of humps and ruts under heavy traffic; (5) due to the character of the resulting surface further maintenance is rendered difficult and costly; (6) prior to retreatment of roads thus repaired, it is often necessary to remove considerable portions of the bituminous mats with picks and shovels or with scarifiers.

Regulation of Motor Truck and Motorbus Traffic.—During the Board's investigations in 1913 and 1914 of the use of state and county highways by various classes of traffic, the Board became convinced that the laws of the State of New York do not adequately cover the regulation of motorbus and motor truck traffic nor does the Board believe that proper cognizance is taken of the development of the above classes of traffic in connection with the design of the highways of the State. It is evident that a consideration of motorbus and motor truck traffic, due to strains produced by heavy loads being carried over the highways at speeds of up to thirty miles an hour, will materially influence the selection of the type of pavement, the character of the foundation to be used and the determination of the requisite width of improved surface. It was found in 1914 that over 16,000 motor trucks had been registered by the Secretary of State and that over 100 motorbus routes were in operation throughout every part of the State and primarily operated on state and county highways. According to the records the motorbuses carried from five to forty passengers, had a horse power rating of from 20 to 75, and weighed loaded from 1½ to 8 tons. It is of interest also to note that the overall width of many of these buses was 90 inches or more. The Board included in its Report definite traffic regulations for the protection of the state highways, which covered loads, tire widths, speeds, etc., for horse-drawn vehicles, motor cars, motor trucks, motorbuses and traction engines.

The Use of Granite Block for Paving in Breslau, Germany

According to a recent report from U. S. Consul H. G. Seltzer, at Breslau, Germany, granite block, with cement mortar filling, is the paving material used on a greater part of the streets of Breslau, there being 2,059,153 sq. yds. of paving of this character out of a total of 2,483,972 sq. yds. of paved streets.

Mr. Seltzer calls attention to the permanence of all paving in Breslau and states that torn up streets are so rare as to be noteworthy, which, his report states, is remarkable considering the fact that the city lies only a few feet above high water and, there being no stratum of hard rock or impervious clay, the drainage difficulties present a considerable problem. On this account concrete foundations form a most important part in all paving operations.

Recently it became necessary to make repairs to the street railway tracks in a section of the city and an opportunity was afforded to observe the paving operations. The blocks were taken up, it being necessary to smash one block in order to provide a space in which to commence the work of tearing up. Each block as it was taken up was carefully cleaned and piled for resetting. The old sand bed was screened to remove all broken stone and mortar and was then replaced.

The granite blocks, which are dressed with the top smooth, were then set on the sand cushion, water was poured into the interstices and each block tramped solidly into place. The interstices were then filled with a thin cement mortar which, in hardening, made a solid and practically noiseless pavement. The blocks were set square between the rails and diagonally between the rails and the curb. The crown is such as to secure the best possible drainage, but owing to the general flatness of the streets there are often three or more sewer inlets in one city square.

Mr. Seltzer admits that the paving operations are conducted very slowly, as compared with American methods, owing to the attention to detail, but points to the lasting qualities and the practical elimination of repairs as an offset to any loss of time in doing the work. The work is done by contract, the city and the railway each paying a share of the cost. Definite specifications are prepared and the inspection is very rigid. On this account, according to the report, lawsuits for breach of contract or for inferior work are practically unknown.

Materials are sometimes furnished by the city and sometimes by contractors. There are large supplies of good paving granite in the Province of Breslau and large cement works are located at Oppeln, while there are quantities of good buildings and all along the Oder River, which flows through the city.

In addition to the yardage of granite block pavement noted above, the city has 129,288 sq. yds. of asphalt, 53,102 sq. yds. of wood block and 242,429 sq. yds. of streets paved with other materials. There are 32.54 miles of street railway owned by the municipality and 11.37 miles of privately owned lines.

Features of Bridge Design

ATTENTION is called to some important features of concrete bridge design by a paper recently read before the American Society of Civil Engineers. The paper, as stated by the authors, "is largely a plea for an arch consisting of two ribs, rather than one with a solid soffit; with narrow rather than wide ribs; and with deep ribs of I-section rather than of rectangular section. It is also especially a plea for the three-hinged as compared with the fixed and two-hinged arches."

The tendency of modern practice, as pointed out by The Engineering Record, is undoubtedly toward the arch with a number of ribs rather than that with a solid soffit. Examination of the plans of many of the later arches with several ribs, however, cannot but raise doubt in the minds of many engineers as to the lateral strength of these ribs. It has taken years of experience in the construction of steel bridges to evolve the present satisfactory rules for bracing compression chords in a sidewise direction. No compression member is properly reduced in length unless it is held by bracing as deep as the member and rigidly attached to it; moreover, such bracing must be capable of transferring all lateral forces to the abutments of the bridge. When proper lateral support is provided, much of the economy of ribs over the solid soffit disappears.

The use of the I-section, instead of the rectangular, has not the sanction of many engineers. The excessive cost of the forms and the difficulties of making them tight and of spading the surfaces, will in most cases offset the saving of concrete effected by the I-section. Before adopting the rib design in preference to the solid soffit arch for short and medium-length fixed spans, it should be remembered that the stresses due to rib shortening, temperature, and shrinkage are proportional to the moment of inertia of the cross-section.

The claims for the three-hinged arch as to ease of stress analysis and adaptability to location where the foundations are not absolutely unyielding, are generally acknowledged. But the claim that temperature, shrinkage, and rib shortening stresses are eliminated in the three-hinged arch is not fully realized, since there is a large frictional resistance at the hinges. From the standpoint of adequacy of design, therefore, hingeless arches, designed for temperature, rib shortening, and shrinkage stresses, cannot be said to be inferior to the three-hinged arch in the design of which these stresses are neglected.

The superior appearance of the arch without hinges is conceded by the authors, but no great weight is attached to it. Yet this superior appearance, due to the gradual increase in the thickness of the arch-ring from the crown of the skew-backs, is important wherever regard must be paid to architectural considerations.

In the comparisons of the cost of the several arches and their piers, too much weight is given to the saving of concrete, for it is a well-recognized fact that a few yards of concrete more or less do not affect the cost of a structure as much as the character of the work itself.

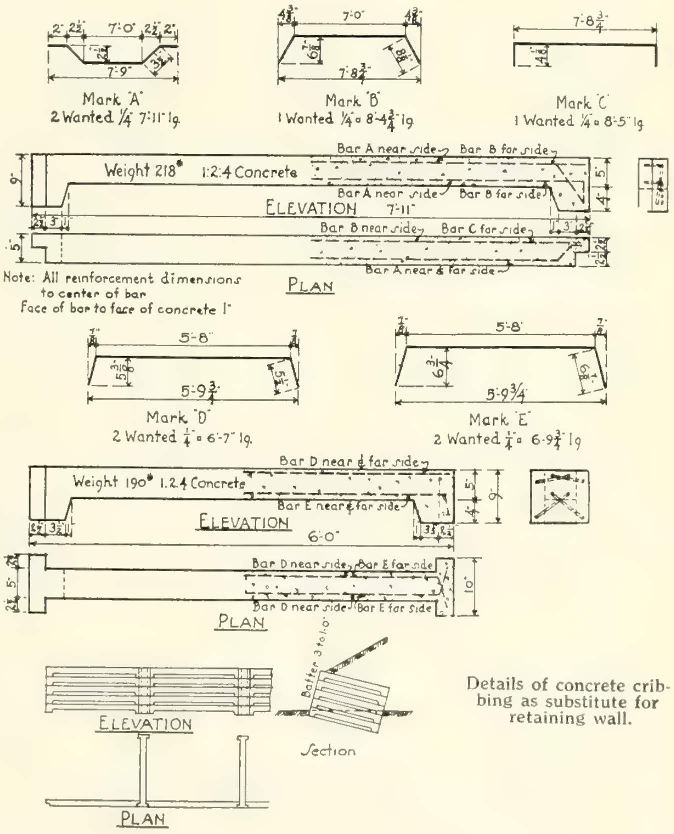
The pier recommended by the authors, consisting of two legs instead of the solid rectangle, will hardly be accepted with readiness by the majority of engineers. Piers with two legs and cross-struts would require more form work, fully as much excavation, and a higher grade of concrete for the same efficiency of structure as would the plain rectangular pier. It should not be forgotten, too, that the plain rectangular pier is generally of sufficient size to justify the use of cyclopean masonry, while the other type does not lend itself so well to the use of displacement stones.

There are other features that will undoubtedly receive consideration at the hands of engineers, but these brief comments will serve to indicate some of the lines along which there should be much valuable discussion.

Crib Substitute for Retaining Walls

CRIBBING of reinforced concrete, of the type illustrated in the accompanying detail drawing, is now used in some locations by the Chicago & Western Indiana Railroad as a substitute for the ordinary retaining wall, to hold the slope of banks. Mr. E. H. Lee, vice-president and chief engineer of the road, states that this cribbing has proved more economical than a retaining wall, and should be more durable than the common timber crib, which it imitates in form.

The faces members are about 8 feet long, and have the ends recessed to receive the T-heads of anchor members 6 feet long. Both face and anchor units are 5 by 5 in. in section, with ends 9 in. deep giving 4-in. vertical openings between units It is thought, however, that in future work it will be an advantage to reduce the width of these openings. The concrete is a 1 : 2 : 4 mix, made with gravel or crushed stone that will pass a 1-in. ring. The face units have 0.054 cubic yard of concrete, and 32 feet 8 inches of ¼-in. square steel reinforcing bars; the anchor slabs have 0.047 cubic yard of concrete, and 26 feet 10 inches of steel bars. The weights are 218 lbs. and 190 lbs. respectively.



Details of concrete cribbing as substitute for retaining wall.

This cribbing was designed primarily as a substitute for retaining walls in certain locations where the height above ground would not exceed 8 to 10 feet. It is placed so as to give a heavy batter on the face (3 in. per ft.), in order that any tendency to slide may be resisted by the vertical rise of the members.

Among the advantages of this construction are: (1) A reduction of 75 to 80 per cent in cost as compared with retaining walls; (2) the possibility of easy adjustment in case the height needs to be changed; and (3) permanence as compared with timber cribbing.

Concrete Bridge Floors*

IN the Cleveland work, it was required that the railroad bridge floors be relatively noiseless and waterproof. In former years every effort has been put forth to build shallow floors so as to minimize the change of grade. Such floors have always permitted the muddy waters to seep through upon people passing below and have operated as drums in accentuating every sound from the passing trains. To overcome these defects the floors were made of I-beams and concrete slabs upon which tracks were laid and ballasted as upon the ground. Such a design requires a greater depth of floor, which means a greater change of grade, and more steel to carry the added weight of concrete. The bridge is therefore more expensive; but in cities where the noise is troublesome, the ballasted floor is a great improvement. Trains passing over such floors are noticed but little more than when passing solid ground.

A concrete floor slab can also be made reasonably watetight. The writer's first experience with concrete was on the Missouri in 1887-88. Later it was used a little on the New York state canals, and still later in bridge construction on the Nickel Plate. During this period many experiments had been made and papers written in which it was sought to demonstrate that concrete can be made practically impervious to water and also that it cannot. Much concrete had been built that was very porous and there sprung up numerous business enterprises for the manufacture and sale of waterproofing material. Both observation and experience indicated that watertightness could be secured by either with waterproofing. The requisite seemed to be that the material and workmanship should be the very best. If poor waterproofing were placed over poor concrete, the structure would leak. If the concrete were good, it would hold water, either with or without the waterproofing.

Especial efforts were made to avoid the entrance of water between the steel and concrete and at points of contraflexure and where cracks might develop from temperature changes. Bevel flashings of steel were riveted to the girder webs and malleable cast flashings were fitted around the stiffeners to cover and seal the edge of the concrete. This design was very successful. At points of contraflexure over curb supports and at Cedar Ave. over the centre columns, it was realized that cracks would develop and an attempt was made to forestall their appearance by the construction of joints. The joints were carefully provided with gutters and drainage pipes, and it was hoped that no trouble would be had with the water. The cracks were successfully forestalled, but the drainage was unsuccessful. The channels soon became clogged with cinders and the details of the steel work in the gross-girders did not leave room for a sufficient body of concrete, and in some instances the concrete proved imperfect. So, while the slabs proved generally tight, there has been some leakage at the points of contraflexure.

Much reliance had been placed on the use of direct labor and carefully selected foremen, but there came a great rush of work at a critical time and the floors suffered. In East Cleveland at a later date, it became necessary to build waterproof joints at the hinges of the arch bridges.

The concrete in the floor-slabs cost about $12 per cubic yard in place.

Now that the bridges are completed and have been two or more winters in service, the conclusions are as follows:

1. Concrete can be made watertight, under low heads, for all practical purposes.

2. The mixing, placing and ingredients of concrete are subject to such a great number and variety of defects that only the keenest attention will secure an impervious structure.

3. Contraflexure temperature changes and settlements will produce cracks.

4. It is best to forestall cracks with predetermined joints.

5. Joints may be sealed against water if well designed.

On the underside of the bridge floors the concrete is protected from locomotive blasts by cast-iron plates, ½ in. thick and 36 in. wide. They weigh 71 lbs. per lin. ft., and cost $5.23 per ft. in place.

Color Possibilities of Concrete

ONE of the strongest objections by architects to the employment of concrete for the external finish of enclosing walls is the unpleasing tint of the material as ordinarily prepared. A good deal of attention has been devoted to the surface treatment of concrete. White Portland cement has been used in many cases, but its cost is rather prohibitive for average work. Coloring matter, mixed with the sand before the addition of cement and water, is employed by various firms engaged in the production of concrete stone. The most satisfactory way, however, of obtaining a pleasing color and texture in concrete surfaces is to select aggregates of appropriate tint, and to clean away the cement so as to expose the stone. A surface so produced will not deteriorate and is exempt from the disadvantages attaching to rendered and to artificially colored surfaces. The film of cement coating the aggregate can be removed by brushing while still green, afterwards treating the work with a weak solution of hydrochloric acid, and washing away all traces of acid. Concrete surfaces may also be tooled in the same way as natural stone, the best results being obtained by mixing the concrete to be so worked with aggregate of small gauge. The material must be thoroughly hard before tooling, otherwise sharp edges and surfaces of fine texture cannot be obtained. By the judicious combination of tooled surfaces and details with surfaces obtained by the exposure of colored aggregates, the architect will be able to secure results of very pleasing character, and which possess the merit of exhibiting the materials actually employed throughout the construction.

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* Abstract from The Elimination of Grade Crossings on the N. Y. & St. L. R. R. in Cleveland, Ohio, by A. J. Himes. Bulletin No. 160, A. R. E. A.

Developments in the Manufacture and Use of Brick

Specially contributed by W. D. Alsip*

IN the very early ages of mankind, burned clay was discovered and was used to house and serve man. It is intended to go into the history of the development of the craft of brick-making. We will take burned clay ware that we find on the present market for construction purposes, and see if we can eradicate some of the abuses and create a clearer apprehension of some of the causes and effects that tend to curtail the use of this best of all fireproof material.

Under the heading Brick we have a great variety, which I will divide as follows: 1st, common building brick; 2nd, face brick; 3rd, paving brick; 4th, fire brick.

Common brick are made by several processes, viz., A—slop or water-slipped soft mud brick; B—sand mould, soft mud brick; C—"Auger," "Plunger machine," wire cut, or stiff mud brick; D—dry pressed brick; E—hammer machine, semi-dry clay brick.

(A) Slop or water-slipped brick are only manufactured in a small way, and therefore need not be considered.

(B) Sand mould brick are manufactured by hand, either by a striker or moulder. The clay is prepared (tempered with plenty of water) and delivered on a table. The striker cuts a wedge-shaped slice off, large enough to fill a little more than the mould, and casts it into the mould with force enough to fill the corners and edges. The clay must strike the bottom of the mould first, then spread and fill from bottom to top to avoid wiping off the sand which has been deposited on the mould before coming to the striker, otherwise it will not be possible to get the brick out of the mould, which usually holds six brick. After the moulds have been filled, the caps or clauds are struck off with a strike-stick, which is taken from a water trough and thrown back to be added to the next mould or brick. The sand mould brick are also manufactured "by hand" by a moulder. This process is used when clay is fat or sticky and does not leave the mould freely. The moulder cuts off enough clay to equal about a brick and a half, and rolls it in sand forming a pointed claud, which is cast the same as described above, except that the cups are cut off by a wire bow. Sand mould brick to-day are nearly all machine-made, and they are an improvement on the hand-made product. Clay used is usually taken from the surface deposits. The brick when burned weigh from four to four and one-half pounds, and are of a more or less porous nature. Canadian standard brick weigh less than most of the American manufacture, owing to the panel or frog which is moulded into the flat or bottom side of the brick. Sewer, face, common and fire brick are manufactured by this process.

(C) Auger machine, or wire cut brick are manufactured from plastic clay with just enough moisture to cause the clay to work into shape. Some machines mould the clay stiff enough to pack or pile eight high without losing their shape. Shales and surface clay are used. The fat clays take much less power. The brick are very dense, and weigh from five to six pounds. Paving, sewer, face and common building brick are manufactured by this process.

(D) Dry pressed brick are made of surface and shale clays. The clay must usually be worked and dried and then ground into a fine state. This ground clay or dust contains about seven ounces of water per brick, and is fed into the machine, where it is subjected to enormous pressure. In some districts common building brick are manufactured by this process.

(E) Hammer machine brick are made by a machine that tamps the clay into the mould, in much the same manner as a quartz stamp mill. These machines are only used, I believe, in the St. Louis, Mo., district, and doubtless they will soon disappear.

The Uses of Brick

We now come to the uses of brick. Most makes of brick have sufficient strength to carry all the load required of them in ordinary building. Your local engineer will determine and pass on all questions of this nature. There is little room to doubt the strength of a brick which has been built into a twelve or fifteen-storey skyscraper, and found not wanting. Such a brick will or should be accepted for stores, warehouses, dwellings and structures requiring less pressure. Where concentrated loads are to be carried on piers, or at ends of steel beams, clinker brick or paving brick should be used. Brick laid up in lime mortar make a good wall, but when laid in mortar cement, a wall is produced that is nearly indestructible and will stand for generations. In cold climates, such as prevail in Western Canada, the architect and builder must keep in mind the power of the various kinds of brick to resist cold. A porous body will absorb and conduct much less cold or heat than a solid or dense body; therefore in selecting the brick for building a wall for a dwelling where the walls are only nine inches and thirteen inches thick, a porous brick will make a much warmer house. The same applies to blocks, stores and apartments, where steel or reinforced concrete are used. The curtain walls are light and therefore must be built with brick that will be as nearly non-conductive as possible. The old-fashioned stone house, the new concrete house, and the wall built of vitrified street pavers, are all the best cold conductors it is possible to select, and if these materials must be adopted, then the best backing or lining should be used to insure a warm building. A stone or concrete wall should be lined on the inside with porous hollow brick, to which at least twenty-five per cent. sawdust has been added, and burned out, producing a fireproof body much like cork. The plastering may be applied directly on these brick, and no bad effects will be produced in the coldest weather. Walls finished with water-colored kalsomine have stood season after season in kitchens and laundries, when this method of construction has been adopted.

The old method of furring or strapping the walls, and lath and plastering, is not as effective, as it is found nearly impossible to keep the air in the room from coming into contact with the wall, and forming frost or dampness, which in turn forms mould or must, which when dried out forms dust, which permeates the rooms, and is the cause of much sickness. Many cases of hay fever, tuberculosis, rheumatism and kindred ailments can be traced to damp houses. Damp, cold houses are not caused—as many believe—by the moisture passing through the walls, but by the walls becoming cold or hot, and then having hot or cold air come in contact with them, causing the moisture in the air to condense and deposit drops of water, much as a glass pitcher will do when filled with cold water on a humid day. In building a block, warehouse, or home, as much and more care should be exercised in selecting the brick for the different parts of the work as is used in selecting material for any other part of the building.

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* President Alsip Brick, Tile and Lumber Company.

A freight depot or warehouse might require a vitrified paving brick to stand the hard knocks, and keep clean of soot and dirt in a down-town district. A stable would have to be built better and with more care—as to the ability of the structure to keep dry—than perhaps any other building. The large amount of moisture thrown off by a stable-full of horses, just in from heavy work, will condense on the walls of a concrete, stone or solid brick wall, but when lined up with porous hollow brick or tile, this is almost—if not entirely—overcome. For a dwelling-house a faced brick, more or less porous, that will keep clean and ripen in appearance by age, is preferable to a more dense or waterproof brick, and when backed up with a porous hollow brick or block it will produce a dry, warm house that will save fuel, do away with draughts, and be a joy to the owner all his life. Speaking of draughts—often in a house where windows and doors are airtight there is a constant draught in cold weather, caused by the heated air of the room coming in contact with the cold solid wall. The cool air settles to the floor and is drawn towards it, causing a draught that is very disagreeable and apt to cause colds and ill-health to the occupants.

In conclusion, this slogan should be adopted by all builders: "The best is not too good."

What Are Porous Bricks?

THE definition of porosity with respect to building bricks has recently been the subject of some discussion, and the following observations, by a correspondent of our London contemporary, The Building World, is of interest.

With the exception of engineering bricks, all ordinary building bricks are somewhat porous; that is to say, they will absorb water, though the amount so retained in the pores varies greatly with different bricks.

In the south of England the average amount of water absorbed by bricks during complete immersion is about 12 per cent. of the weight of the brick. North of the Trent and in Wales somewhat denser bricks are usual, and the average water absorption is seldom over 8 per cent. of the weight of the brick.

Bricks made by the semi-dry process—that is, by compressing the clay in the form of a damp dust, absorb only about 5 per cent. of water, though they vary greatly in this respect. Engineering bricks absorb less than 1 per cent. of their weight of water. For all ordinary purposes, therefore, it is not desirable to designate bricks which absorb less than 15 per cent. of their weight of water, on immersion, as particularly porous.

During the last few years the use of hollow blocks and hollow bricks has extended rapidly. These are much lighter than solid bricks and effect an important saving in railway carriage, but they must be distinguished from porous bricks. The weight alone is not a sufficient guide, as hollow bricks are now made which are indistinguishable in appearance from solid bricks. When cut or broken their hollowness is easily seen. On the Continent, porous bricks are defined as having a weight which is notably less than common bricks, but this definition will have to be abandoned now that hollow bricks are made in large numbers.

The large, hollow blocks used in fireproof floors, etc., are usually made of a highly porous material. This not only reduces the cost of carriage and the weight of material in the structure, but it facilitates manufacture of blocks accurate in shape and free from twists.

A simple test for porosity consists in holding the tongue lightly in contact with a brick. If a distinct suction is felt the brick will be very porous; if no appreciable suction is apparent, but the moisture rapidly dries from the surface, the brick is but slightly porous. Engineering and non-porous bricks will not absorb water, even if poured on to them.

A much better test consists in weighing a dry brick, immersing it in water for twenty-four hours, wiping it dry with a few rapid strokes of a clean cloth, and then re-weighing it. The weight of water absorbed will indicate the porosity. It is true that the water may not penetrate all the pores, but the test is sufficiently accurate for most purposes.

The bricks used in architecture should be moderately porous, as, otherwise, water condenses from the air, and the resultant water collects in drops on the inside of the walls, spoiling the wall paper and giving the impression that the building is damp. If the pores are sufficiently minute the bricks may be as highly porous as possible. The more porous they are the better will the walls "breathe." Bricks with large, coarse pores should be avoided, as they admit rain water too easily, and walls in which they are used often remain permanently damp.

The Dominion Steel Corporation production for the month of June, with comparisons, was as follows:

	June, 1915. Tons.	June. 1914. Tons.
Pig iron	22,552	21,111
Steel ingots	28,680	26,620
Rails	13,044	16,998
Rods	6,435	1,981
Bars	797	2,347
Wire and wire products	3,167	1,541
Coal mined	481,820	485,449

The Pan-American Road Congress is to convene on Monday, September 13th, at the Municipal Auditorium, Oakland, Cal. Many leading authorities on road work and paving have accepted invitations to the meeting, among these being Mr. W. A. McLean, Chief Engineer of the Ontario Highway Commission.

Transmission-Line Towers: Foundations and Erection

At the recent convention of the American Institute of Electrical Engineers several of the papers dealt with the practice of power companies in providing adequate supports for transmission line steel towers and in erecting the structure.

Toronto Power Company

Notes on the old and new 60,000-volt lines from Niagara Falls to Toronto were contributed by F. C. Connery, Superintednent of Transmission Lines of the Toronto Power Company. About one hundred sets of the type shown in Fig. 3 were dug up after seven years' service. In no case was the galvanizing deteriorated, and the impregnated wood blocks were in a fair state of preservation. These were used with standard 40-ft. two-circuit towers. With some 53-ft. double-circuit towers the wood blocks were omitted. Six such towers were erected in black muck, which gave no resistance with borings to 40 ft. Plank sheathing was driven around each leg location, the muck dug out and a floating foundation of impregnated 2-in. plank put down at 6 ft. below the surface. The stubs were set in concrete about 1 yd. to a footing. There has been no settlement or change of alignment in a year.

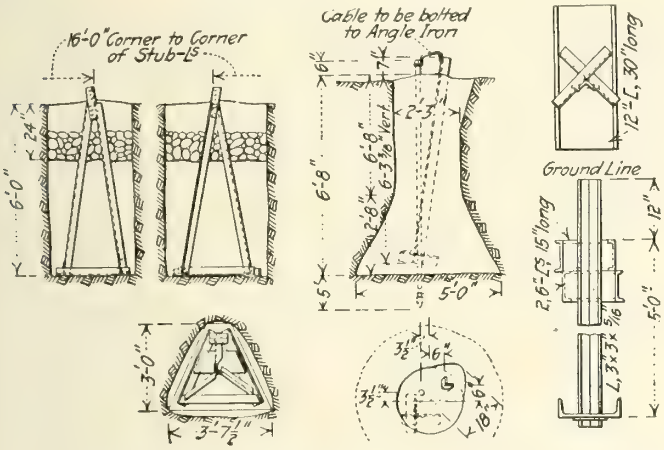


Fig. 1.—Old tower foundations, Pensylvania Water and Power Company.

Stubs were bolted to a steel template lined up on centre line stakes and levelled with a carpenter's level. One man backfilled, while two tamped, water being used when available to settle the earth.

A type of very narrow-base latticed towers or poles was employed on a 6 x 6 x 6 ft. 1:3:5 concrete base with twelve 1¼-in. anchor bolts. The foundations for some of these poles varied beyond a minimum depth of 6 ft.; then they were erected on 12 inches of concrete and the excavation filled with concrete around the pole.

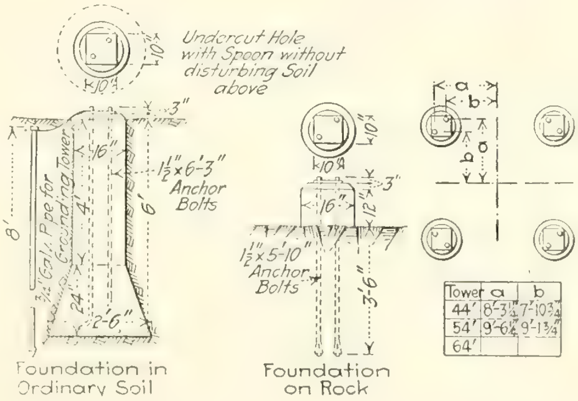
New tower footings are now being designed as follows: (1) modified screw guy anchor for light structures, (2) a screw guy anchor with a large footplate on a shallow concrete slab, (3) a screw pile with top plate for the tower foot plate, and (4) threaded wood pile. It has been found unnecessary to drive a pile to refusal to get a good tower footing, there being sufficient skin friction in the upper layers of soil.

J. A. Walls, Chief Engineer of the Pennsylvania Water & Power Company, reported that, on the line from Holtwood (or McCall Ferry) to Lancaster, bell-bottomed concrete foundations had been used, and also on the anchor towers of the Holtwood-Baltimore line. Buried steel tripod stubs were used for the intermediate towers of the latter line. Lifting tests were made on steel single-leg and tripod stubs (the former with top and bottom fins) and the bell-bottomed concrete supports. The single-leg stub pulled out at about 23,000 lbs., the tripod type at 32,000 lbs. and the concrete was untouched at 70,000 lbs., the capacity of the testing outfit. These supports are shown in Fig. 1.

For the second Holtwood-Baltimore line (a short and important trunk of very heavy construction) it was decided to use concrete stubs, and four types were investigated—(1) bell-bottomed without forms, (2) bell-bottomed with steel forms, (3) bell-bottomed with wood forms, and (4) truncated pyramids with wood forms. They were more or less satisfactory, in the order named, and the first type (Fig. 2) was selected.

Post holes 3 to 4 feet deep and 16 inches in diameter were dug and the bell scooped out with a spoon. If the soil for any hole was too hard for this, a half-stick of 40 per cent. dynamite was first shot in a small hole punched down about 2 feet. In rock two or three shots generally opened an entire hole. Ordinarily, one man dug two or three holes a day. One man was put on each hole and a foreman had charge of three or four gangs. Holes were laid out by rods and cord from reference stakes, only about five minutes being required for a base. Attempts were made to shoot out the holes in ordinary soil with a full stick of 60 per cent. dynamite and two half sticks of 40 per cent., but this was not generally successful.

The concrete mix varied from 1:2:4 to 1:3:5. Sand and ¾-in. stone were shipped in carload lots to various stations along the line and distributed by four-mule teams—1.5 yd. of stone and 3.4 yd. of sand being dumped at each tower site. These amounts were increased 50 per cent at each fifth tower. Cement was stored in farmers' barns—100 to 200 bags to a place. Mixing and pouring for one tower required about three-quarters of an hour, while moving and setting up required about an hour. A 2.5 cu. ft. hand mixer on two wheels was used. It weighed 1,000 lbs. with platform. A portable runway elevated the mixer enough to let a wheelbarrow go under the chute. Water was hauled in a two-horse steel tank, which was filled with a 4-in. boat pump from creeks. It would have been better to use a lighter wagon with a small suction pump and 15 feet of hose.


Undercut Hole with Spoon without disturbing Soil above
10"
10"
3"
¾" Galv. Pipe for Grounding Tower
8'
16"
4'
1½"×6'-3" Anchor Bolts
6'
24"
2'-6"
Foundation in Ordinary Soil
10"
10"
3"
16"
12"
1½"×5'-10" Anchor Bolts
3'-6"
Foundation on Rock
a
b
a
b

Tower	a	b
44'	8'-3¼"	7'-10¾"
54'	9'-6¼"	9'-1¾"
64'		

Fig. 2.—New footing. Pensylvania Water and Power Company.

The smallest number of men needed in concreting was nine—under one foreman. Two or three more men were often used to advantage, especially in moving. One to three teams were employed, depending on the length of haul for water and cement. Water in the anchor holes was pumped out. A short length of 6 in. sheet iron pipe for depositing concrete would have been better where holes filled fast.

The tower bed plates were not on hand at first and dummy plates were tried, but did not give a good seating for the plates. Some piers were left 8 ins. below grade and finished with the plates later. After the bed plates were on hand the concrete was poured to within 1 inch of the top of the anchor bolts and the plates hammered down on the soft concrete to the grade given by the instruments.

The actual cost per tower averaged:

Hauling	$13.20
Grading	2.27
Digging	4.92
Materials and concreting	28.50
Total	$48.89

The steel was assembled on the ground in a horizontal position and towers were erected by a rigging gang of 11 tower legs to prevent damaging the footings. A 3-ton motor truck is the best motive power for raising the towers and for transporting equipment. Nine men with a truck will raise and fasten down an average of nine towers in a 9-hour day.

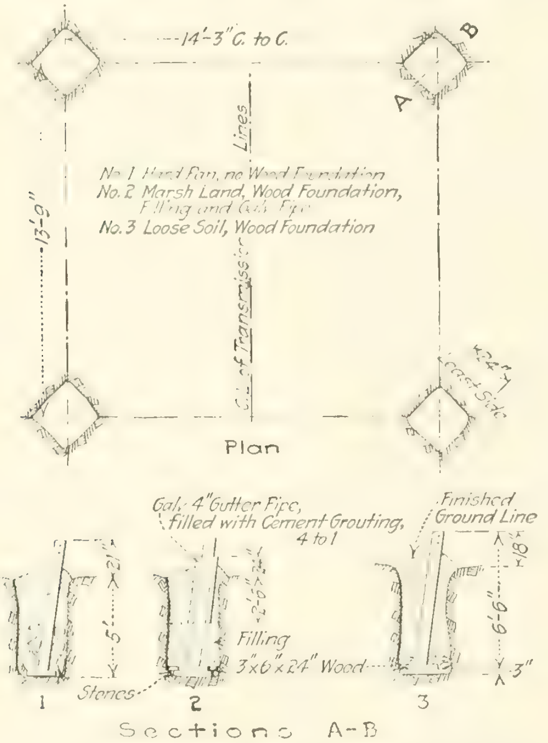

14'-3" C. to C.
B
A
Lines
C.L. of Transmission
No. 1 Hard Pan, no Wood Foundation
No. 2 Marsh Land, Wood Foundation, Filling and Gal. Pipe
No. 3 Loose Soil, Wood Foundation
13'-9"
24"
East Side
Plan
Gal. 4" Gutter Pipe, filled with Cement Grouting, 4 to 1
Finished Ground Line
12"
5'
2'-6"
Filling
3"x6"x24" Wood
18"
6'-6"
3"
Stones
1
2
3
Sections A-B

Fig. 3.—Foundations for 40-ft. towers. Toronto Power Company.

Speaking at the Junior Institution of Engineers on "Bridge Construction in Bolivia," Mr. C. W. Glover, jun., said that in the districts through which the rail ways pass the only negotiable route is very often one along the banks of the rivers. Thus necessitates frequent crossings over the many tributaries, which during the floods, bring down large quantities of mud, loose rock, and trees, owing to the resulting accumulation the mouth of the tributary spreads out into a fan-shaped mudbank, or "mazamorra," from 25 to 33 feet deep. When properly drained and sun-dried, these "mazamorras" are quite hard, and apparently quite firm; but a 10 minutes' rain-storm is often quite sufficient to convert each into a moving quagmire, which will carry away any bridges constructed upon it in the dry season. The accumulation of debris often completely buries bridges constructed to span the mazamorras. Under-bridges have in many cases been substituted for over-bridges, but have proved inadequate to cope with the enormous loads involved.

An Old Stone Staircase

WHILST engaged in carrying out structural alterations at an old hotel at Poole, England, the workmen discovered what is considered to be a secret stone spiral staircase associated with the smuggling days. The premises date back two or three hundred years. The staircase had been ingeniously constructed in the wall, with a stout beam on the outside. Entrance is presumed to have been made through a cupboard placed on the right-hand side, and from the ground floor to the first floor there are niches in the wall for the feet, above being a series of steps. In the side of the wall about four feet from the ground is a square framed cavity, through which contraband goods were passed.

There is also an old-fashioned door containing old lights, upon the glass in one of which has been scratched "William Milner, Junior, November 8th, 1783, Custom House, Poole."

Removing Iron Rust Stains from Stucco

IN the case of a stucco house the iron work in various places rusted and discolored the stucco. The owner wanted to know how to remove this rust from the stucco and wrote the Concrete-Cement Age in regard to it.

The question was discussed by two experts, one of whom offered the following suggestions:

"If these stains are purely of surface discoloration, it should be possible to remove them with a wire brush; if, on the contrary, the entire thickness of the stucco has become stained, it will be necessary to put on a cement wash to cover the spots, or to cut out the stained portions and jut on new stucco."

The other expert suggested this procedure:

"A solution of hydrochlorite acid and stannous acid will remove iron rust from concrete, and will not injure the concrete if the treatment is administered rapidly and the face immediately washed with clean water. The solution mentioned has an affinity for carbonate of lime, consequently it should not be used where hydrated lime has been incorporated in the mixture. Rough finished cement stucco should be treated by spraying with the above solution as the result will be more thorough and the work more rapid than by the use of a brush. Satisfactory results may also be obtained by diluting one of the commercial cement paints until it is thin enough to use in a spray pump, and painting the surface of the stucco by spraying the diluted paint upon it."

According to the statement of General Bertram, six thousand artisans are employed in Canada, drawing weekly wages of $1,000,000 in 247 factories, manufacturing shells for the war arena. Orders for 9,000,000 shells have been placed here by the shell committee and for 8,100,000 cartridge cases, fuses, primers, and friction tubes. For these contracts orders have been placed for 170,000 tons of steel, 30,000 tons of lead and several thousand tons of other material. Canada will be shortly turning out 50,000 shells a day.

A Discussion of Mechanical Traction for Municipal Work[*]

By Ernest J. Elford[†]

IT is important that the municipal engineer should keep in close touch with improvements in methods, materials, and appliances, among the more important of which last-named mechanically-propelled vehicles for use on highways occupy one of the most foremost positions. They are of great variety, being driven by steam, petrol or petroleum, and—more recently—by electricity. Some are complete carryings units, whilst others are capable of hauling only other vehicles carrying the load. Each type has points of advantage and disadvantage as compared with the others, according to the conditions under which it is required to work. It should be borne in mind, however, that it is not under all conditions that mechanical traction can successfully compete with horses. From the financial point of view, perhaps, the most important factor is rapid loading and discharging. Some appreciable delay at each end of a journey with horse-drawn vehicles is unavoidable, and, in fact, desirable, but loss of time with motors makes all the difference between profit and loss. A motor unit is much more expensive in first cost and running cost than a horse unit, and it can only be made to pay by carrying much larger loads at a much quicker rate. It seldom pays to buy second-hand motor vehicles, as it is during the first few years of their life, when they can constantly be kept at work, that they are most profitable. Where motors are used it is desirable to employ as many as can be kept constantly at work, as under these conditions five, six or more can be used to greater advantage and more profitably than one or two. For instance, large loading and unloading gangs can be employed, and this means shorter terminal delays. The cost and delay of repairs can also be much reduced when there is sufficient motor or other work to justify the provision of a workshop and staff, so that repairs can be done promptly at the depot. In addition, where a number of steam vehicles are employed, the boiler cleaning and overhauling can be done at night by a separate gang, who can also light the fires and get up steam ready for the drivers in the morning.

Steam-driven Vehicles.—Their chief advantages lie in their comparative simplicity, substantial construction, flexibility, and large reserve of power. Any man of ordinary intelligence who has been used to driving a steam roller or engine can soon become capable of driving a steam vehicle, and, as a rule, the results of any inexperience or carelessness are not so serious as would be the case with a petrol vehicle. If well-designed, built, and cared for, a steam vehicle will last many years. The reserve of power of a steam engine is often of great value when the vehicle is operating over bad roads, or when it is necessary temporarily to overload, while, except in the event of serious damage, a steam vehicle is seldom entirely incapacitated, so that it can generally be driven home. It can, too, be more easily adapted as a stationary engine for driving plant. Another factor in favor of steam vehicles is their low running cost. As to disadvantages, the boiler, coal supply, etc., add considerably to the weight; they are not available at short notice, as steam cannot be raised in less than forty-five minutes; washing out and overhaul of the boiler usually takes about six hours each week, and where the water is not suitable the boiler is likely to give trouble by leaking tubes, priming, etc.

Petrol Vehicles.—The author has used both steam and petrol vans for street watering, and is of opinion that steam vans are better for this purpose where they are convertible for general haulage purposes, but that petrol motors are better where they are used only for street watering. The latter are always available for instant use, cover a great length of road in a given time, and are quieter. The majority of motor vehicles used for municipal work are convertible. In many cases they are used during the summer months for street watering and during the remainder of the year for general cartage. For the former purpose it is the author's practice to use cylindrical tanks for quantities up to 600 gallons and rectangular tanks for larger quantities. The smaller tanks are provided with petrol motors, which are used almost entirely for street watering and sewer flushing. The larger tanks generally have a capacity of about 1,000 gallons and are used with five-ton steam motors during the summer only. The author is a firm believer in rubber tires, except for vehicles which use bad roads, where the wear and tear of this material is likely to be abnormal. He is also of the opinion that it pays rather to over-tire than to under-tire, and it is his practice to specify for the wheels of a five-ton steam vehicle the largest rubber tires made The rubber tires of some of the vehicles under his control are maintained under contract at a charge of 1¾d. per car-mile per set of six tires—twin tires on driving wheels. The cost of this arrangement compares satisfactorily with the purchase of tires outright. The author has not had experience of any petroleum carburettor suitable for petrol vans, but has found this fuel quite satisfactory for motor rollers, which are comparatively slow-moving.

Electric Vehicles.—These are likely to be of advantage for the collection and cartage of house refuse and other municipal work. The Southend corporation has for some months been running an electric omnibus in service with petrol omnibuses, and, on a test of fourteen double journeys, the electric vehicle covered 89 miles at an average speed of nearly 9 miles per hour, including stops. The route was undulating, with sharp gradients in places, the omnibus was well loaded on all journeys, and the current consumption was at the rate of 1:56 units per mile. From experience up to date it appears that an electric omnibus will cost from 10 per cent. to 15 per cent. less per omnibus mile than a petrol omnibus. One great advantage of the electric drive is that a skilled driver is not required. For the collection of house refuse the Edison Accumulator Company suggests 3-ton electric vans, having a capacity of 8 cubic yards, and 2-ton vans having a capacity of 8 cubic yards. The speed of the 3-ton vehicle fully loaded is given as 8 to 9 miles and of tre 2-ton as 10 miles. The weighing and tipping at the destructor is estimated to occupy 5 or 6 minutes. The larger vehicles are proposed for the longer and the smaller for the shorter distances. Each size vehicle is estimated to collect and deliver to the destructor from 9 to 9½ tons of refuse per day. The paper concludes with some valuable figures giving estimated cost of maintaining and running 2-ton and 3-ton Edison accumulator vans respectively, and average day's cost of street watering, gulley and street flushing, etc., (a) by steam vehicles, provided with convertible bodies, and (b) by petrol vehicles, adapted for street watering and sewer flushing only.

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[*] Paper presented at the annual meeting of the Institution of Civil Engineers.

[†] Borough Engineer, Southend-on-Sea, England.

The Training and Work of the Engineer

By H. T Wakeham

THE work of the engineer covers an extremely wide field, the constant extension of which renders almost every department of physical science a necessary and fundamental part of a course of education, founded upon a proper basis of mathematics, for those entering the profession.

To a theoretical preparation there must, before a man can be said to be thoroughly equipped for his work, be added a sound practical training in the particular branch of the profession he chooses to follow, or wherein to specialize. It is a "long, long way" to final success, but in this way only can an engineer hope to succeed in his work. Such a training will enable him to bring to bear that thought, concentration and economical adaptation so necessary for that inventiveness and accommodation to circumstances which many members of this institution have so skillfully displayed in the past, and which have been the means of helping them to the high positions they hold in the profession, which positions they have so hardly won by efficient work and constant application. The measure of a man's theoretical knowledge is proved by his success before a board of examiners, but practical experience can only be obtained in the workshop and on works of construction, where a man will, if at all of an observant nature, quickly see how and where his theoretical ideas require modifications to meet actual constructional conditions. While I think it is absolute necessary for a sound theoretical training to be afforded to beginners in the profession, I must confess that I have a sneaking liking for the man who possesses ideas prompted by practical work.

If I may be allowed to address a few words to the younger brethen, I would say, select as models two or three of the more successful practitioners of the institution and follow their examples. By so doing success will probably ensue. "Rome was not built in a day"; neither will the higher positions in the municipal and county engineering world be won in a day's work. Such positions are, however, always open to those who care to take the trouble—as our American friends would say—"to get there."

I would also impress upon the younger members the necessity for visiting works during the preparation of materials and during the actual constructional operations. The measure of a man's knowledge cannot always be judged from the length of his experience. For instance, two men may go through exactly the same job, and at the end one of the two may show a much greater knowledge of both its principles and details than the other. This arises from the degree of observation exercised by both men. Where one fails in this, another succeeds. Much can therefore be gained by observation, and the more visits that are made to works in progress the more knowledge will be gained by the observant student.

While offering a word of encouragement to those juniors who have already started their professional careers, it would not perhaps be out of place if I also tendered a few remarks on the advantages of the engineering profession. With the world power of England—such as is held by no other nation—its vast possessions, its interest and influences, there is an almost unlimited field for a display of energy by men who possess constructive ability and capacity. In comparison with other professions, engineering offers many opportunities for men to gain, not only a good living, but to rise to positions of eminence in life—positions of which there are none of more utility.

The most successful engineers have been those who have been decisive and courageous in their views, and who have possessed tact and capacity for hard work. In addition to these essentials, a constitutional condition sufficient to withstand all kinds of weather and physical and mental strain, form necessary attributes if a man is to succeed.

With regard to the scholastic work of a boy desirous of entering the profession, I personally think that such a boy, until he attains the age of sixteen or seventeen years, should be well grounded in mathematics, mechanics, physics, chemistry and geometrical drawing. A boy at the age of seventeen who can pass an examination equal to the standard of the matriculation examination of the University of London should (provided he continues evening classes during his pupilage) very quickly make headway, given the attainments and attributes I have already referred to.

Should it be within the power of the parents to take a boy from school, say at the age of sixteen, and send him direct to an engineering college to take a science degree in engineering, or to an engineering school provided with laboratories and workshops, it would add greatly to his advantage. He would in this way combine theoretical study with practice of the kind he would obtain in an engineering works. This knowledge should fit the boy for the work he would afterwards be called upon to perform in connection with his pupilage in a manner satisfactory to himself, and would remove, to a great extent, the feeling of hopelessness which often assails some pupils when asked to proceed with work which to them appears both abstruse and difficult, but which in reality presents no difficulty to those who have been sufficiently well grounded in their preliminary studies.

On the other hand, young men who have received a college training must not forget that there are many things which they cannot have learnt during their college course, and that it will take years of practical experience to complete their engineering

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[*] Abstract of presidential address before the Institution of Municipal and County Engineers.

education, and enable them to take up responsible positions.

An artistic draughtsman who lacks that constructional knowledge which will enable him to prepare a sound specification explanatory of his work will not be able to keep pace in the world's competition with the man who can prepare a fairly good drawing with a specification fully explanatory of the practical work he desires should be carried out.

The work of the engineer is fast becoming more and more technical and important, and with the march of time and competition it appears to me that the best-trained men will have the greater chance of success, not only in the particular branch practised by members of this institution, but also in all other branches.

Going briefly into the history of engineering, we find that one of the first works of magnitude was carried out by those of whom we speak as "the ancients." It was no less a work than the construction of the canal uniting the Red Sea with the Nile. That canal, we are told by Pliny, was originated and begun by Leostris. Others say that the work was carried out by Necos, and finished by Darius I., 525 B.C. To whomsover the work may be properly assigned, its existence shows that engineers were actively at work many centuries ago.

As one of the first engineering works of which we have an authentic record was in connection with the Nile, it may not be misplaced if I recall the fact that within recent years a stupendous engineering feat, known as the Nile dam, was carried out across the same river, with which work a present eminent member of this institution was conspicuously connected.

Previously to the eighteenth century there were many celebrated undertakings carried out by engineers, among them being the dome of St. Mary's, Florence, by Brunelleschi, and the dome of St. Peter's, Rome, by Michael Angelo. Other great engineers who practised centuries ago were San Michalin, the supposed inventor of the military bastion system, and Pagan and Vauban, who were both celebrated in their different branches of work.

During the eighteenth and nineteenth centuries, and also in our own time, there have been many successful engineering achievements of considerable magnitude connected with which, during the more advanced period, both past and present members of this institution were engaged. In regard to some of the achievements for which members have been responsible one may refer to large extensions of the main drainage works of the Metropolis, the main drainage works of Frankfort-on-the-Main, the supply of water from Wales to Liverpool, the supply of water from Wales to Birmingham, and the additional supplies of water to London. The Manchester Ship Canal, the Forth Bridge, the Tay Bridge, the Tower Bridge, the Simplon Tunnel, the Severn Tunnel, the Mersey tunnels and the Thames tunnels, and many other works, comprising vast undertakings and expenditures, have also been carried out within comparatively recent times.

The Victorian era saw many of the large trunk railways and canals of this country brought into operation, while it appears but yesterday that the Great Central Railway and several of the large metropolitan tube railways were completed and opened to traffic. The original construction of railways in this country gave a great impetus to the work of the engineer. Some of the undertakings which made such men as Stephenson, Telford, Brunel and others famous are the bridge over the Tyne, the bridge across the Menai Straits, and the tubular bridge at Saltash, which monuments appeal to us to-day.

Those members who are acquainted with the works I have enumerated may with pride arrogate to themselves the satisfaction of being connected with a profession which has produced men of the capacity of those who carried out the works to which I have referred.

Causes of Metal Bridge Corrosion

DISCUSSING, before the Engineers' Society of Western Pennsylvania, the protection of metal structures, Frederic H. Fay, of Fay, Spofford, & Thorndike, consulting engineers, Boston, pointed out that the corrosion of metal bridges is due principally to one or more of four causes. These are exposure to locomotive gases; exposure to sea water; exposure to surface water leaking through bridge floors; overstress of the metal, by which corrosion has been hastened.

The condition of frequent wetting by salt water, followed by exposure to the atomsphere, is a severe test. The Neponset bridge, built in 1877, was a small two-leaf trunnion bascule draw span with wrought-iron girders. The counter-weighted ends of the girders were immersed in salt water whenever the bridge was open at high tide. These girders were painted frequently, usually with red lead, and they continued in service thirty-two years, until the bridge was rebuilt.

Laboratory experiments have shown that steel stressed beyond its elastic limit will rust more rapidly than steel which is not overstressed. This seems to be borne out by experience in certain cases of highway bridges carrying constantly increasing street railway loads. When heavy cars have been put in service over these structures the outstanding legs of the flange or seat angles immediately under the stringers have been found to rust very rapidly—much faster than the metal at each side of the stringer.

Recognition of the Engineer

For years the B. C. branch of the Canadian Society of Civil Engineers have been concentrating their efforts upon placing the engineer on a better footing, so far as the public recognition of his merits is concerned. Their effotrs would appear to be succeeding in part, if one can place a favorable construction upon the importance the Vancouver Province attaches to a certain event chronicled in the following paragraph:—

> Mr. G. Miles Peters, Government Engineer in charge of the False Creek dredging operations, had blushes blooming over the whole length of his six feet four inches to-day when his friends and acquaintances became aware that the lengthy engineer had had a daughter added to the family. The Government official bore his honors with meekness and restraint but he is infernally proud just the same.

Time was when an engineer would have had to have more inches than Mr. Peters—and more daughters than one—to have merited such dignified attention at the hands of the press.

From Mr. W. A. Littlejohn, City Clerk, we have received a copy of a Municipal Handbook of the city of Toronto for 1915. This valuable publication, which is issued annually, contains complete information on practically every phase of civic activity, as well as many practical notes and statistics relating to constructional developments.

Comparative Building Costs

COMPARATIVE figures of cost always appeal to the building contractor, and those given in one of the committee reports presented at the lumbermen's mass meeting recently held under the auspices of the Forest Products Federation in the City of Chicago, cannot fail to prove of more than ordinary interest. The report in question dealt with the comparative prices of building construction, and was prepared by J. Norman Jensen, architectural engineer of the building department of Chicago.

Mr. Jensen pointed out the extreme difficulty of giving comparative costs between residences which are built of frame construction and those built of other types, but in order to obtain a comparison between the cost of small frame and brick buildings in the City of Chicago, an architect prepared complete plans and specifications of quite a number of one and two-storey buildings and then obtained bids.

Since in making any comparison, the interior finish, plumbing, etc., is assumed to be the same, the final analysis is in the cost of the walls of the building. The cost of labor and materials in place, of the walls of these small buildings, exclusive of the plastering of the walls, runs about as follows:

Frame

	Sq. ft.
2x4 in., 16 in. centres, yellow pine studding	5c
1x6 in. sheathing, and 1 layer of paper	5c
Cypress drop siding	5c
Painting	2c
Total	18c

Brick

8 in. common brick side wall	21 to 22c
4 in. face-brick and 8 in. common-brick front wall	45 to 50c

Stucco

2x4 in., 16 in. centres, yellow pine studding	5c
1x6 in. sheathing, and 1 layer of paper	5c
Stucco on galvanized wire lath	12c
Total	22c

In the above analysis common-brick is estimated at $16 to $17 per M., material and labor. All the above prices include the contractor's profit. From this analysis it is seen that the cost of the common-brick and stucco wall is about the same, and that the walls of a frame building cost about 20 per cent. less than either of them; 4-in. face-brick and 8-in. common-brick front wall is about two and one-half as expensive as a frame front wall.

In each case in which a frame building was compared with a similar brick building the size of rooms, plumbing, trim, interior, finish, etc., were identical. In all cases the frame building had a shingle roof while the brick structure was provided with a non-combustible roof. The average of these bids on these buildings was as follows:

	Frame	Brick
One-storey cottage, 22x30 ft.	$1,719	$1,823
One-storey cottage, 20x36 ft.	2,394	2,684
One-storey cottage, 21x48 ft.	3,419	3,906
Two-storey flat, 24x34 ft.	4,185	4,564

From these figures it will be seen that the cost of the frame building was about 10 per cent. less than a similar brick building.

The substitution of inferior materials, or the using of materials less in quality or quantity than that called for in the specifications, is known to the constructor as "skinning the job." This is one of the factors which is helping to legislate against the use of lumber in mill constructed buildings. A specification is drawn up intending to obtain the best grade of material. Some enterprising dealer, or contractor, or other party, deliberately places an order for an inferior lumber. The mill man either does not know or does not care about the deception. The lumber gets on the job, and then the trouble begins. The architect or engineer condemns the sticks sent, but the owner needs his building in a hurry and accepts the lumber under protest. The architect listens more attentively to the concrete man on the next job, and the lumber salesman wonders why he does not get any more orders out of that architect's office. The architect can watch the local materials which go into his concrete building, but he does not intend to stand over the mill man perhaps a thousand miles from his office.

With regard to the cost of what is known as mill construction as compared with other types of construction, it may be stated that one advantage of the former is lower cost. Perhaps the best way to compare costs is to mention a number of actual bids on completed structures. In a certain large architect's office a design was prepared of a building which was to be erected in an old manufacturing district in Chicago. The building was five storeys and basement high, 100 by 100 feet, and designed for 280 lbs. live load. The panels in the standard mill design were 14 by 16 feet, and brick bearing walls were used throughout. The concrete building of the same height and size was designed in the most economical type of flat slab concrete skeleton construction. The actual bid for the mill constructed building was $65,100 and for the concrete type $72,200.

Another building seven storeys and basement high, 68 by 75 feet, was designed for 150 lbs. live load. The panels in both designs in this case were 18 by 16 feet. The mill constructed building cost $65,400, and the concrete building $75,300.

If wood floors had been required in these buildings, the difference between the mill and the concrete prices would have been greater than ever. In the buildings which were compared, the elevators, heating, lighting, sprinkler equipment, etc., were the same.

It is useless to attempt to make a sweeping statement as to how much a mill constructed building should cost per cubic foot, or square foot, or a concrete building on the same basis. Sometimes a mill constructed building of a certain area would have to be divided by a brick wall with fireproof doors, from basement to roof. A similar concrete building would not require this dividing wall, according to building ordinances. The cost of this brick wall alone would offset part of the cost of the concrete building. The best that can be done is to take all the known facts into consideration, and try to arrive at general conclusions, based on a great many comparative designs, and on the experience of the best architects and builders.

The writer has before him a long list of buildings constructed within the last four years in a newly developed manufacturing district in Chicago. The vast majority of these buildings are of the mill constructed type, ranging in cost from $15,000 to $225,-

000. The cost per cubic foot ranged from 6c to 11c and per square foot 80c to $1.70.

The range of costs is so great that no generalization can be made on them only. The point which the writer wishes to make is that these buildings were built of mill construction in preference to concrete or other type of construction. In a great many cases these buildings were designed in other types of construction besides mill. The same exterior walls, the same mechanical equipment, the same sprinkler system, etc., was used throughout, the only variation being the type of floor construction adopted By comparing the costs of the different types of construction, the following conclusions were reached:

With column spacing not exceeding 16 feet, mill constructed buildings designed for 100 lbs. live load cost 20 per cent. less than concrete buildings; for 150 lbs. live load, 15 per cent. less, and 200 lbs. live load about 10 per cent. less. When the live load was 350 lbs. or over a concrete building was cheaper.

It was stated that the above analysis was based on column spacing of 16 feet or less. When the required column spacing in any building is greater than 16 feet, the relative economy of mill construction disappears. It has been found, however, that the column spacing of 16 feet is ample enough for the vast majority of manufacturing and other mercantile businesses. The live load mentioned is the load per square foot which can be safely put on top of the floor. This live load is usually the weight of machinery, or goods placed on the floor. For most light manufacturing buildings a live load of 100 lbs. per square foot is sufficient, and for 75 per cent. of the buildings used for storage purposes 200 lbs. per square foot is all that will ever be placed on the floors. So the column spacing and the loads cover most of the cases which may arise.

Another point which determines the adoption of mill constructed building in preference to concrete is the fact that in ordinary lines of business the rate of insurance on a sprinkled mill constructed building and contents runs about 25c, while the rate on a concrete building and contents, unsprinkled, runs about 45c. The rate on both types of construction, sprinkled, is about the same, but the cost if installing the sprinkler system in the concrete building makes the total cost still higher in comparison with a mill building. A concrete building in which wooden floors are used cannot compete with mill construction.

Examination of concrete exposed to severe heat in the course of the fire at the Edison works, showed that the material generally was very hard and gave no evidence of calcination. The dehydration observed on the surface did not extend into the mass of the concrete, the strength of which remained unimpaired. A special committee appointed to investigate the fire state that "considering the extraordinary conditions surrounding this fire, the behaviour of the concrete buildings was highly satisfactory and constituted an excellent demonstration of the merits of concrete as a fire-resisting building material."

Some of the modern theories for reinforced concrete design are not practical and do not give the designer any means of knowing what factor of safety his constructions have, and prevent a sound development of the art of reinforced concrete construction.—L. J. Mensch, Chicago.

The Use of Sandstone in Building

ONE of the varieties of stone that has been in important use for structural and decorative purposes ever since the dawn of civilization is sandstone. This is of very wide occurrence, being found in almost every country, and it has such diversity of color and texture that it would naturally be chosen for architectural use, says Stone. Besides its beauty, sandstone has been commended to the builder by its great durability and its resistance to attacks by fire and the acids of the atmosphere. Many of the most notable buildings that have come down from antiquity are of sandstone. Temples and statues in ancient Egypt were cut in this material, although the patient craftsmen were just as willing to carve limestone, granite, or even the intractable basalt and porphyry.

In Persia and the various countries of Asia Minor, gigantic structures were reared in sandstone, the ruins of which have survived to awaken our admiration and wonder. The remarkable rock-cut temples and tombs of Arabia Petra are carved entirely from great cliffs of sandstone. The stone is a beautiful and delicate pink in color, with occasional markings in yellow, and the effect of rich carvings in such a material can scarcely be imagined.

In later times, sandstone was used very generally for cathedrals and churches in England and on the Continent. This made it possible to produce effects not only in stone of yellow and grey but also in brown, pink and red, and striking contrasts were available. It is only within the past few years that the present generation has learned the lesson of the excellent effects of polychromatic construction which might have been drawn long ago from the work of our forefathers. The varying colors of marble and sandstone enabled them freely to apply polychromy, both structural and decorative.

A Mark Twain Story

When Mark Twain in his early days was editor of a Missouri paper, a superstitious subscriber wrote him saying that he had found a spider in his paper, and asking him whether that was a sign of good or bad luck. The humorist wrote him this answer and printed it:—

"Old Subscriber: Finding a spider in your paper was neither good luck nor bad luck for you. The spider was merely looking over our page to see which merchant is not advertising, so that he can go to that store, spin his web across the door, and lead a life of undisturbed peace ever afterwards."

Investigation in connection with electrolytic action on fifteen hundred concrete poles on the Utica-Syracuse lines of the New York State railways during the last five years show of these poles only three developed defects, which, upon investigation, proved to be directly traceable to leakage of the 600-volt trolley current through the reinforcing rod to earth. In every case ample warning of the failure was given by the gradual cracking of the concrete long before the pole was liable to fail altogether. The main interest of the investigation is the conclusive manner in which it contradicts the gloomy forebodings sometimes expressed by the opponents of reinforced concrete on the subject of electrolysis.

The Efficient Control of Reinforced Concrete Construction

A number of casualties have attended construction in concrete. A sudden collapse of a portion of a reinforced concrete building in a large city, attended with loss of life of workmen, generates in the public mind a fear of concrete construction; and a prospective builder is likely to resort to a less permanent and less fitting style of building because of the uncertainty. He knows that a concrete building is serviceable and permanent after the cement has set, but he fears the risk arising during construction.

Structural engineers, on the other hand, know that the percentage of failures is small, and the accidents to be avoidable.

Dangerous conditions in reinforced concrete construction arise from (1) inadequate designs; (2) defective materials, and (3) unfavorable weather conditions and lack of care under those conditions.

All of these elements may be, and are, controlled in the larger cities by building codes and active inspection. For instance, in the city of Chicago, which has an unusually efficient and watchful building department, there have been no serious failures of reinforced concrete buildings under construction. In this city designs are checked over very carefully to see that they conform with the conservative practice established by the building code of that city.

It is in the smaller cities, that are not large enough to demand permanent buildings, but without building codes, that the most dangerous conditions obtain.

The building codes are thought to be too conservative by some designing engineers of companies interested in the sale of materials. For instance, while these codes generally permit 16,000 lbs. stress per square inch upon ordinary reinforcing steel, some designers will increase this to 20,000 lbs. where the code does not prevent, and under circumstances where the sale of the material depends upon a low total price.

Many buildings have been erected under designs that are not conservative and yet have given good service. Their construction has been under favorable conditions with reference to cement, sand, weather conditions, and skill of workmen; and the lack of factor of safety in design has been counter-balanced by the increased factor of safety in materials.

Codes, however, must recognize average conditions. The architect or structural engineer or commercial firm supplying material, who has drawn upon the factor of safety in design, and then has met unexpected conditions in the materials, weather conditions, etc., and has a failure on his hands, is certainly in a weak position.

The larger number of failures of concrete buildings occur during the late fall when the low temperature and wet weather prevent the cement from hardening properly. At this time, too, the owner is anxious to get into the building. Every one is in haste; forms are struck before the concrete is hard enough to support the floors above; the roof, which is often the weakest part of the design, is being covered with cinders into which the rain seeps. Instead of weighing 45 lbs. per cubic foot, the weight of these cinders may run up to 100 lbs. per cubic feet. Then, too, the plumber may seriously overload a portion of the floor with piles of pipes, may even remove a form support. Under these conditions it is no wonder that failures occur. In the presence of these unfortunate failures a designer who has furnished a conservative design is in a strong position.

The writer has investigated and made reports upon several failures in which it has been necessary to criticise the design. In some of these cases the architect has originally made a conservative design with sufficient materials and proper connections. The sales engineer of a company supplying steel has afterward prevailed upon the architect and owner to allow a substitute design. The latter is shaved down to the lowest limit, involving high stress in steel, short laps for bond, and defective continuity. While the substitute design will save in the cost of steel, the per cent. saved on the cost of the entire building is usually small and will no justify the risk of the entire structure.

While recognizing the fact that methods of construction and dimensions of structures proceed partly upon experience and the desire for economy, the writer urges that, in the case of reinforced concerte, designs should follow building codes and the report of the conservative practice as fixed by the joint committee on concrete and reinforced concrete which has recently been adopted by the American Society of Civil Engineers and the American Society for Testing Materials.

The standard designs of some of the constructing companies are also reliable and conservative. A special mention might be given to the Kahn standards of the Trussed Concrete Steel Co., Detroit, and those of the Corrugated Bar Co., Buffalo, for the dimensions of beams and girders of ordinary floors and roofs.

The codes, however, are naturally behind hand in respect to the newer forms of construction, such as the so-called "flat slab" design.

In construction with new materials the tendency is to follow forms that have been developed for old materials. Thus the first reinforced concrete building used the old wooden construction of girders, floor beams, and slabs between the latter.

In another line the first railway coaches were patterned after stage coaches.

Reinforced concrete, however, is continuous, like the old constructions.

The flat slab designs omit girders, and floor beams. There is a continuous slab over the entire floor, and it rests upon and is monolithic with the expanded heads of the columns.

The steel is disposed in either a four-way system or a two-way system.

These constructions are usually patented. Advantages are (1) the better lighting of the room, (2) the increased head room, (3) decreased storey height, (4) more simple installation of sprinkling systems, (5) simpler form work, and (6) a construction more in keeping with the material.

The construction is generally considered more suitable for loads up to 500 lbs., and columns spac-

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*By W. K. Hatt, in the Ohio Architect.

ing up to 24′ than for larger loads and wider spacing. When the panel becomes rectangular instead of square, the long side should not exceed the short side more than 1-3 part.

The depth of slab should be at least 1-30 the span between column centres.

The design of the expanded head of the column needs attention. It should be stiff.

The steel is in the bottom of the slab at the centre of the panel, and passes up to the top of the slab near the quarter point of the span.

The steel that passes from one panel to another should lap well over into the next span at least 60 diam. beyond the edge of the column cap. And where both bars are counted upon as reinforcing over the column, they should keep well up in the top of the slab over the column, and run 60 diam. beyond the quarter point of the span.

The amount of steel should be about the same in the various patented arrangements for given loads and spans.

Over the column head, the amount of steel should be sufficient to resist an external bending moment equal to 1-15 W/L (for interior square panel); where W=total load, live and dead, on panel; L=span centre to centre of column along direct line.

Carbon-Paper Tracings for Blue-Printing

An interesting expedient was adopted by Lloyd T. Emory, of Philadelphia, Pa., for getting out a set of working plans in a hurry, and is described in Engineerings News. The only drawing materials on hand were two triangles, a hard pencil and a scale. Getting some tough tissue paper from a dressmaking establishment, he first made the drawings in pencil on the tissue paper, then laid some sheets of carbon paper face up on the table with the tracings over them and retraced all the lines of the drawings, thus backing them with the imprint of the carbon. Only 48 hours was available for the set of plans. In 20 hours straight work they were completed, and time enough was left to get them printed in the blue-printing room of a local shop. He had since used the idea extensively.

The claim is made that with carbon tracing a paper drawing can be done in one-fourth or one-third the time of making an ink tracing; but not all draftsmen will agree on this point. In any event the method is applicable only to simple drawings—large-scale details and the like—and not to drawings with fine detail, etc.

When several drawings with the same foundation work but with alternative details are to be made, a modification of this method might be applied, using double-faced carbon paper and two or more sheets of paper.

Extensive public and private works are in progress in many parts of New Brunswick. The contract has been awarded by the Provincial Government for the construction of a new bridge across the Petitcodiac at Moncton. The contractors are already on the ground and hope to have the substructure well advanced before cold weather sets in. Three large churches are in course of erection at Moncton. A school building of large size, and a city hall and market are also planned. Bathurst has awarded the contract for an extensive water and sewerage plant. The contract price is about $131,000.

Mainly Constructional

East and West—From Coast to Coast

John G. Scurry, a railroad engineer, widely known on the Pacific Coast, died last week at Seattle. The late Mr. Scurry was seventy years of age.

On the recommendation of Mr. M. J. Butler, the Montreal Council have decided to expend $360,000 on the construction of a retaining wall on the north side of the filtration plant.

Mr. W. A. McLean, Chief Engineer of Highways for the Province of Ontario, has submitted a report in connection with the completion of the Toronto-Oshawa road, which he estimates would cost nearly $300,000.

The new factory which is to be erected at Hamilton, Ont., for the T. Eaton Company, Limited, is to cost $150,000. The proposed building is L-shaped in design, four storeys high, of reinforced and brick construction.

Although by no means brisk, there is a slight improvement in the builders' supply trade of Montreal. This, of course, is the busiest period of the season, and the local demand, together with buying from the province of Quebec, has helped to make the situation more favorable.

The Mayor of Toronto is authority for the statement that the last obstacles in the way of constructing the new Union Station at Toronto have been removed. He states that the Toronto Terminal Company is now in possession of ample funds and that the contractors, the Lyall Construction Company, are ready to go on with the work.

With the name of Boving Hydraulic and Engineering Company, Limited, J. B. Flavelle, W. Flavelle, D. McLean, J. Carew, and T. H. Stinson, all of Lindsay, Ont., have incorporated a company for the purpose of carrying on the business of mining, electrical, mechanical, hydraulic and civil engineers and contractors. The capital stock of the new company is $500,000.

Mr. F. McArthur, City Engineer of Regina, is leaving the West shortly to return to Guelph as City Engineer. This is the second time that Mr. McArthur has been City Engineer of Guelph so that he has the particular advantage of being familiar with engineering conditions in the Royal City. He first went to Guelph as City Engineer in 1898, fresh from graduation at Queens University, Kingston, and went to Regina three years ago.

The Canadian steel industry would appear to have great possibilities according to a report given out last week in Montreal by Mr. A. M. Rogers, who had just returned from a tour through Nova Scotia. Mr. Rogers is authority for the statement that both the Dominion Steel Corporation and the Nova Scotia Steel Corporation are working full blast, having tremendous war orders. They are engaged in making rails, rods, billets, and nails, and the Dominion Company are also manufacturing toluol, the new high explosive base secured from coal tars.

Mr. Angus Smith, City Engineer of Prince Arthur, Sask., has received the degree of C. E. from the University of Toronto. Mr. Smith graduated from the School of Science in the year 1894 and has been constantly engaged in municipal engineering since that date. It is of interest to note that Mr. Smith has the distinction of having built the only sea walls for foreshore protection in Canada—one the Dallas Road sea wall and the other the Ross Bay sea wall at Victoria, B. C., the former being 1,700 feet long and the latter 3,800 feet long. These walls were built at the same time, but they are absolutely different in design—each being suitable for its particular situation. The structures have withstood severe storms during the past four years and they are considered one of the engineering points of interest at the coast.

Preparations are being made for the installation of equipment in the rooms set apart for the Ceramic Laboratory at Toronto's new Technical School. A kiln will be constructed under the direction of Mr. A. F. Greaves-Walker, of the Sun Brick Company. The design is the same as that made by Mr. Walker for the new Government testing plant at Ottawa and erected under the direction of Mr. Joseph Keele. A re-press is being presented by Mr. J. E. Frid, president of the C. N. C. P. A. H. C. Baird, Son & Company, of Parkhill, Ont., will supply a No. 2 Kells machine with clay feeder, and an 8 x 20-in. end delivery pugmill, together with the necessary cut-off tables and dies. This equipment will be installed at an early date, and will be ready for the beginning of the course in ceramics this fall. The Sun Brick Company, of Toronto, are giving a Martin upright six-brick stock ma-

The Canadian Western Foundry and Supply Company is the name of a new corporation, organized and financed by Alberta men, which will form an important addition to Calgary's industrial concerns. The new company has been formed by an amalgamation of the International Supply Company, of Medicine Hat, the Western Foundry and Equipment Company, of Calgary, and the Canadian Equipment and Supply Company, of Edmonton and Calgary. It is capitalized at $1,000,000 and its officers are as follows: President, W. H. McLaws; Vice-President, T. A. McAuley; Treasurer, F. Leslie Bell; Secretary, A. T. MacWilliam; Manager, Geo. A. Mackenzie. The company will handle plumbing and heating supplies, builders' supplies, railway contractors' supplies, oil and gas well supplies, and heavy foundry and brass work. They will make a specialty of heating and ventilating returns for schools and churches. The company's plant at Medicine Hat is now working night and day making high explosive shells for the army.

The Passing of a Great Engineer

Sir Sandford Fleming, the distinguished engineer who was regarded as the Dean of the profession in Canada and as "the father of the Canadian Pacific Railway," died last week at Halifax, N. S., at the advanced age of 88. Born at Kirkcaldy, in Fifeshire (Scotland), in 1827, he came to Canada at the age of eighteen and joined the engineering staff of the Northern Railway, Toronto, of which subsequently he became Chief Engineer. In 1863 he was appointed by the British and Canadian Governments to conduct a survey for the first link of a railway joining the Atlantic and the Pacific. His plans showed the practicability of the scheme, which developed when carried out into the Canadian Pacific Railway system. Among many of his other important enterprises was the railway system of Newfoundland. In 1877 her late Majesty Queen Victoria made him a Companion of the Order of St. Michael and St. George, and he became a Knight Commander in 1897. Sir Sandford Fleming had received honors from many of the leading universities. He had been Chancellor of Queen's University several times.

Sir George E. Foster, Acting Premier, pays the following tribute:

"The death of Sir Sandford Fleming deprives Canada of one more of its outstanding men. His connection with the early history and construction of the Intercolonial Railway, his intelligent and very useful contribution to the construction of the first transcontinental railway, and his eminent services in respect of the Pacific cable connecting the Australian and the Canadian colonies entitled him to high rank among the pioneer builders of the Empire, and gave him a distinguished place in the history and development thereof. As a man and a citizen he had enjoyed long years of respect and esteem, and had contributed worthily to the upbuilding and ideals of the communities in which his labors were so faithfully bestowed."

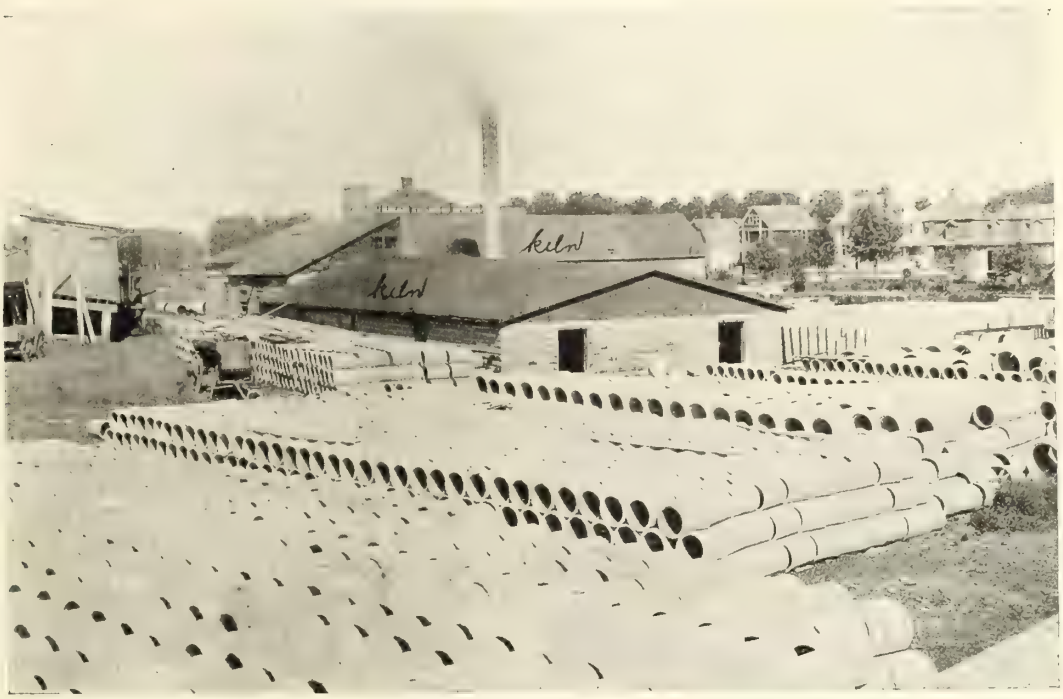
A particularly significant tribute is paid the late Sir Sandford Fleming in a leading editorial in "The Globe" (Toronto), of which the following is an abstract:

"It is no exaggeration to say that Canada has never had a citizen more distinguished or better known to the world at large than the late Sir Sandford Fleming. A native of Fifeshire, Scotland, he came to Canada at eighteen, and during the seventy years between his advent and his passing he was from first to last the architect of his own fortune and fame. With only a moderate amount of educational preparation, either general or special, to start on his professional career, he left behind him a record of individual achievement in his own line that is and must always remain both unprecedented and unparalleled.

"He was fortunate in coming to this country at a time when great projects were much in the minds of Canadian and British statesmen. Railway building was just in its infancy when he joined the engineering staff of the Northern Railway, and in 1857 he was promoted to be its chief engineer. In 1863 he was asked to report on the feasibility of connecting the then Province of Canada by rail with the Red River Valley. Quite naturally he was entrusted in 1867-71 with the routing and construction of the International Railway, and after the purchase of the Hudson Bay Territory by the Dominion of Canada he was just as naturally put in charge of the greater undertaking, the Canadian Pacific Railway. From 1871 to 1877 he was in full charge of the difficult task of exploring the West, selecting a route for a transcontinental railway, and planning the style of line that would best promote the various purposes it was designed to serve: colonization, transportation, and inter-communication. The intercolonial and transcontinental railways within the Dominion are Sir Sandford Fleming's enduring professional monuments.

"In his private pursuits the bias of his mind was not merely theoretically scientific but practically constructive. He was always the "engineer," but always also the "scientist." By dint of intellectual ability and untiring industry he not only kept himself abreast of the scientific movements and discoveries of others, but acted as a pioneer in making and publishing discoveries of his own. He was a persistent and ultimately successful advocate of a transpacific submarine telegraph line. He was the first to suggest what is known as "standard time," which is now in use over most of the civilized world. He was the author of numerous monographs of a scientific character, in which he published to the world the conceptions that were the outcome of his own inexhaustible versatility. It is fitting to mention in this connection the great service he rendered to the cause of science in Canada by the active part he took in founding the Canadian Institute, for which he never ceased to display a friendly and helpful sympathy.

"Unlike many members of his profession, Sir Sandford was deeply interested in higher politics and political history. He was always an ardent but sane Imperialist, and when the "Trent affair" came to Canadians in 1861 as a trumpet call to active defensive service, he raised a company of volunteers in this city. Like many other thoughtful observers, he saw clearly the remediable defects of the ordinary method of electing representatives to Parliament, and he thought out and published practical suggestions for its betterment. He was always ready to assist in movements to commemorate the sites of great historic events. The high esteem in which he was held is amply shown by the honors paid and the distinctions conferred on him by learned bodies and institutions. In private life Sir Sandford was one of the most charming of men: intellectual, cultured, courteous, but withal unostentatious, and unaffected. We shall not soon look upon his like again."



Plant and pipe storage yards of the B. Blair Company, Limited, at Woodstock, Ontario.

The Manufacture of Concrete Pipe on a Large Scale

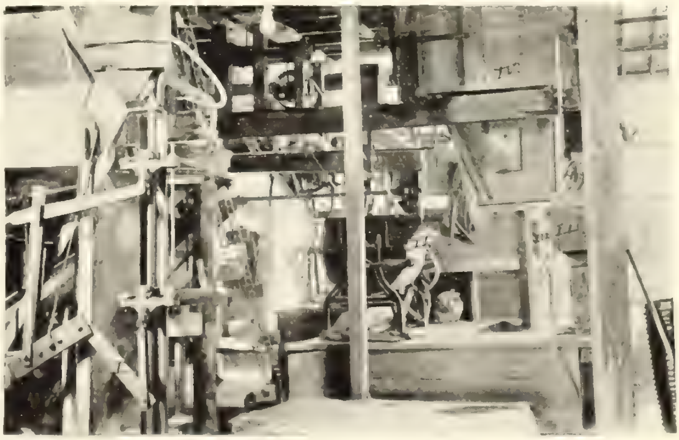
The manufacture of concrete pipe is carried on on a considerable scale in Woodstock, Ont., at the plant of the B. Blair Company, Limited, which is specially equipped for the manufacture of these pipes in sizes from 4-in. to 36-in. The factory is equipped with a 30 h.p. steam plant, and two 15 h.p. motors, 3 stone crushers, concrete mixer, cement tile machine, and a large power tamper. For the hardening of the pipe after moulding there are two large vaporizing chambers, and seven chambers for the smaller sizes. These chambers have over 6,000 feet of floor space, and are all fitted with a system of overhead water pipes for spraying concrete pipe during the process.

Gravel is placed in a No. 3 Eureka crusher and delivered to a large storage bin. A bucket conveyor takes it from the bin as needed to a revolving screen, where the sand is separated from the stone, which is further reduced in a No. 2 crusher to an aggregate suitable for making tile. This aggregate ranges from fine sand to 5/16-in. stone, and is measured into a batch concrete mixer with sufficient cement and water to make a gum mix consisting of one part cement, one part sand, and two parts stone.

Concrete is passed automatically by bucket conveyor to the moulds for the smaller pipe or to the power tamping machine for the larger pipe. This tamping machine strikes 150 blows of 350 pounds every minute, which gives the pipe great density. After moulding, the pipes are placed in the vaporizing chambers for 72 hours, where they are subjected continuously to fine sprays of water in a temperature of 110 deg. Pipe cured under this system have been tested to a pressure of 60 pounds to the square inch without showing any signs of seepage.

The capacity of the plant is three carloads a day. The

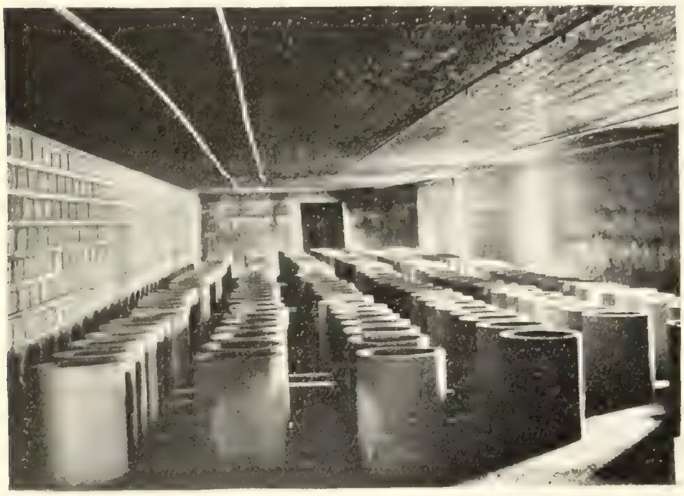
Power machine making pipe from 4 to 16 inches in diameter.



Power pipe machine, batch mixer, measuring box and storage bin.

power tile machine has a capacity of 3,000 feet a day of pipe ranging in size from 4-in. to 14-in. The large power tamper has a capacity of 600 feet day of 14-in. to 36-in. pipe. For making extra large concrete pipe the company have three portable plants which can be shipped to any point and placed where required for the making of the large pipe. The larger pipe, from 24-in. upwards, are all reinforced with heavy Hy-Rib Metal or Triangular mesh.

The firm have patented an entirely new feature in connection with their concrete pipe. By means of a special circular form a square slot is pressed around the joining ends of the pipe. When the pipe are joined together the slot is filled with a flowing cement batter or a liquid asphalt which forms a perfect bond when thoroughly set, and makes the joint absolutely watertight. The cut herewith illustrates the manner in which this joint, when set, not only forms a waterproof ring, but bonds the ends of the pipe together. The advantage of a lock joint of this character can readily be seen, since the pipe when laid in a trench make one continuous line as strong at the joints as in any part of any pipe section.



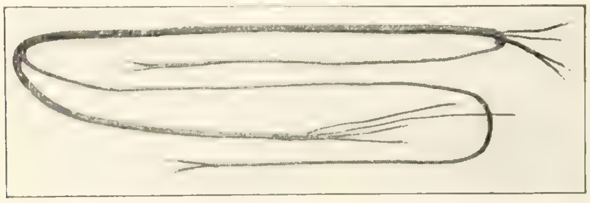
Interior of vaporizing chamber for large pipe, where pipe remain for 72 hours.

Mr. B. Blair has made a close study of concrete sewer pipe for the last seven years, and has visited the leading plants in the United States, with the result that the company's Woodstock plant is one of the largest in America, both in point of equipment and in capacity.

Mr. Blair is President of the American Concrete Pipe Association, having held this office for two years.

Cable Assemblies for Motor Cars

The Standard Underground Cable Company of Canada, Limited, Hamilton, Ont., are furnishing their automobile cables in assembled or "harness" form, as shown in the illustration, complete with terminals and ready for installation. This method of selling cable was adopted by this company as a convenience for the buyer and it is said to also possess the advantage of economy, and to make for neatness, since a good assembly makes the best looking installation on the finished car. The assemblies are made up to suit the dimensions of the cars on which they are to be installed and, since the necessary terminals are already attached, there is nothing to be done in installing the cable but make the connections.



Automobile cables manufactured by the Standard Underground Cable Company of Canada, Limited.

Centrifugal Blowers and Compressors for all pressures from 5 inches of water, as in mechanical draft service, up to 125 lbs. per square inch, as for compressed air distribution in mines, machine shops, ship yards, etc., are described in a 64-page book issued by the De Laval Steam Turbine Company, of Trenton, N. J. The development of the high efficiency, high speed centrifugal blower or compressor has been conditional upon improvements in materials, construction, shop practice and design such as are employed in the building of high grade steam turbines. By careful calculation of stresses, and by the use of good materials and workmanship, it is possible to run blower and compressor wheels safely and satisfactorily at peripheral velocities of 150 to 600 ft. per second, which makes it possible to develop as much as 3 or 4 lbs. per square inch pressure in a single-stage blower. In the present publication numerous charts are given, showing curves for the isothermal, adiabatic and actual compression of air, also the theoretical power required to compress air and characteristic curves of single—and multi-stage blowers and compressors. The influence of impeller design upon the form of the characteristic is discussed at some length. Particulars are given concerning the application of centrifugal blowers and compressors to forced draft, coal gas manufacture, coke oven plants and water-gas plants, sugar factories, cupola and blast furnace work, Bessemer converters, supplying compressed air in mines, ship yards, etc. The illustrations present numerous examples of blowers and compressors directly connected to steam turbines and to electric motors.

Brass-Wire Armored Cables for Motor Cars and Motor Boats

The Standard Underground Cable Company of Canada, Limited, Hamilton, Ont., are manufacturing a complete line of brass-wire armored ignition, lighting and starting cables for motor cars, motor boats and other motor-driven vehicles.

Brass-wire armored cables—Standard Underground Cable Company.

This armor is in the form of a strong "D" shaped ribbon, wound closely over the cable, and is supplied in yellow, antique or nickel-plated finishes. Galvanized steel wire armor is occasionally used though somewhat less durable in construction. The insulation of these armored cables consists of high grade rubber, varnished cambric, and waxed and varnished braids. Other types have plan rubber insulation without braided covering. The outer braid of the braided cables is saturated with multiple coats of special varnish which give it durability even when not further protected by the brass-wire armor.

"A handful of clay—man. A shovelful of iron ore—a metal sheet." In this unique fashion an unusually interesting treatise on the subject of the corrosion of iron and steel sheets commences, and throughout the entire narrative the reader's interest is held by the writer's ingenious method of handling a subject which is usually technical and "dry" to the layman. The booklet is entitled "Corrosion—The Cause—The Effect—The Remedy" and has just been issued by The Stark Rolling Mill Company, of Canton, Ohio. It is well worth writing for.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Beauceville, Que.

The Town Council will call for tenders shortly on the construction of waterworks, drainage and lighting systems. Engineer, F. Mignault, Sherbrooke, Que.

British Columbia Province

A proposition is on foot for the construction of an 80-foot international road from Blaine and White Rock to Sumas and Huntingdon. Reeve of Matsqui, A. Cruikshank.

Brockville, Ont.

Work is about to start on the construction of an intake pipe for the City Council. Material has been purchased and work will be done by the Board of Works.

Calgary, Alta.

Work will start shortly on the construction of a number of sewers. Engineer, G. W. Craig.

Chatham, N. B.

The proposed reservoir will probably be built by day labor. Material will be purchased by the Engineer, A. N. McKay, and D. P. MacLachin. Estimated cost, $20,000.

Dartmouth, N. S.

Work has been started on the laying of 9-inch sewers and 6-inch watermains under supervision of the Engineer, Eugene Nichols.

The Town Council are considering the extension of the sewer and watermains on Erskine Street. Clerk, A. Elliott.

East Oxford Township, Ont.

Tenders will be received until August 9th by F. G. Jackson, Oxford Centre, for the construction of 800 feet of open ditch drain and approximately 10,300 feet of tile drain, varying in size from 5-inch to 12-inch. Engineer, F. J. Ure, Woodstock.

Elmira, Ont.

The Town Council are considering the installation of a sewage system, estimated to cost $25,000. Engineer, H. J. Bowman, Court House, Berlin, Ont.

Grimsby, Ont.

Tenders on the construction of a cement roadway are being received by the Town Clerk, C. H. Bromley.

Napanee, Ont.

The Town Council propose to lay sewers and concrete sidewalks on several streets. Clerk, W. A. Grange.

Ottawa, Ont.

Work is about to start on the construction of a concrete sidewalk on Carling Avenue, estimated to cost $6,000.

Perth, Ont.

The Town Council have submitted plans for a filtration system to the Provincial Board of Health for approval. Estimated cost, $15,000.

Preston, Ont.

The Town Council have authorized the construction of sewers on a number of streets, at an estimated cost of $8,195. Engineer, C. S. McKenzie.

Regina, Sask.

The City Commissioners will receive tenders until September 6th for the supply of two turbine pumps, each capable of delivering 3,500,000 gallons per day against a pressure of 60 lbs. per square inch. Clerk, George Beach.

Saskatchewan Province

Tenders on the construction of drainage ditches in the province will be received until noon, August 7th, by F. J. Robinson, Chairman of the Board of Highway Commissioners, Parliament Buildings, Regina. Work includes approximately 50,000 cubic yards of excavation. Plans and specifications with the Chairman.

Toronto, Ont.

The Board of Control will receive tenders until August 17th for filling in Catfish Pond and constructing a sewer in connection therewith. Plans at Room 34, City Hall.

Welland, Ont.

The Welland County Council propose to spend $160,000 on improvements to the County roads during the year. The scheme has been submitted to the Provincial Department for approval. Clerk, J. E. Cohoe, 32 Maple Avenue, Welland.

CONTRACTS AWARDED

Bedford, Que.

The contract for the erection of a steel water tank for the Town Council has been let to the Jenckes Machine Company, Limited, at $4,675.

Chatham Township, Ont.

In connection with the dredging work in the Townships of Chatham and Dover, the contract for the supply of pumping machinery has been let to the Chatham Bridge Company, Inches Avenue, Chatham, at $7,700, and the dredging contract to the Chatham Dredging Company, Chatham W., at $6,000.

Cornwall Township, Ont.

The general contract for the construction of the Shaver Creek Drain has been let by the Township Council to James A. Valade, Harrison's Corners, Ont., and he has sub-let to the Van Busen Excavator Company, Crown Life Building, Toronto.

Lambeth, Ont.

In connection with the installation of a waterworks system, the Village Council have let the contract for well drilling to Wright Bros., Petrolia, Ont., at $3 per foot.

Pelham Township, Ont.

Contracts for drainage work have been let by the Township Council to G. Vanalstine, Crowland, Levi Chambers, Fenwick, W. S. Nelson, Fenwick, Charles Bowman, Fenwick, and Adam Bossart, Chantler P. O.

Preston, Ont.

The contract for laying asphalt pavement on King Street for the Town Council has been let to the Standard Paving Company, Central Chambers, Ottawa.

Saanich, B. C.

A contract for a large amount of paving has been let by the Municipality to the Warren Construction Company, Portland, Ore.

St. Catharines, Ont.

The City Council have let the contract for the construction of bitulithic pavements to the Warren Bituminous Paving Company of Ontario, Limited, McKinnon Building, Toronto.

Waterloo, Ont.

The Town Council have let a contract for the construction of concrete sidewalks to Paul Bergmann, King St.

Windsor, Ont.

The Board of Works have recommended that the contract for sewers on Giles, Howard, Goyeau and Alley Streets be awarded to Merlo & Ray, Tecumseh Road, at $7,300.

Railroads, Bridges and Wharves

Grantham Township, Ont.

Tenders on the construction of a concrete bridge will be received until 6 p.m., August 6th, by L. S. Bessey, Queenston Street, St. Catharines. Plans and specifications with the Engineer, F. N. Rutherford, 24 Queen Street, St. Catharines.

Kingston, Ont.

A by-law has been passed permitting the Canadian Locomotive Company, 2 Kingston Road, to construct a trestle and railway switch over the city water lots near William Street.

Levis, Que.

The Municipal Council have had plans drawn for a wharf, estimated to cost $10,000. Engineer, C. Lessard.

Swan River, Man.

Tenders will be received until August 10th by Joseph Armstrong, Box 153, Swan, for the construction of steel superstructure for the Corbett Bridge over the Swan River. Plans and specifications at office of the Provincial Engineer, Parliament Buildings, Winnipeg.

Toronto, Ont.

The Board of Control have had plans prepared for the pedestrian subway to be constructed at Ashdale Avenue. These will be submitted to the Dominion Railway Board. Estimated cost, $11,500.

Work by day labor has been started on the construction of the Innes Avenue Bridge. Approximate cost, $7,000. Commissioner of Works, R. C. Harris, City Hall.

CONTRACTS AWARDED

British Columbia Province

Work has been started on the construction of an extension from Lillooet to Hundred Mile House for the Pacific Great Eastern Railway, 325 Howe Street, Vancouver. The general contract has been let to P. Welsh, and the contract for trestle work to Cullitan Bros. Approximate cost, $3,000,000.

Campbellton, N. B.

The contract for the construction of a dam for the Shives Lumber Company, Limited, has been awarded to W. J. Hunter, Sussex, N. B.

La Loutre, Que.

The general contractors for the dam which is to be built here for the Quebec Streams Commissioners, 264 Parliament Buildings, Quebec, have let sub-let all work to Fraser, Brace & Company, Power Building, Montreal.

St. Ambroise de Kildare, Que.

The Municipality have let a contract for the erection of two steel and concrete bridges to Patrick Marcil, Joliette.

St. Casimir, Que.

The contract for the construction of a steel and concrete bridge over the Steanne River has been awarded by the Municipal Council to Gauthier & Julien, Portneuf Station. Estimated cost, $5,000.

St. Cyprien, Que.

The contract for the construction of bridge abutments for the Municipal Council has been awarded to Lorrain & Daignault, Napierville. Sub-contracts will be let for the steel superstructure.

Tay Township, Ont.

The contract for the erection of a bridge for the Simcoe County Council has been awarded to G. Dupont, care of R. J. Fletcher, Barrie.

Public Buildings, Churches and Schools

Beamsville, Ont.

A by-law will be submitted shortly to authorize the borrowing of $20,000 for the purchase of a site and the erection of a high school. Chairman of the School Board, Mark Fampton.

Bishop's Crossing, Que.

Plans of a school are being prepared for the School Board. Committee, C. C. Rolfe and D. P. McHarg.

Calgary, Alta.

Tenders on the construction of a standard magazine will be received until noon, August 16th, by the Director of Contracts, Militia Headquarters, Ottawa. Plans and specifications at office of the Officer Commanding Military District No. 13, Calgary, and of the Director General of the Engineering Service, Birks Building, Ottawa.

Cardale, Man.

Tenders are now being received on the erection of a two-roomed school for the Consolidated School Board. Plans and specifications with the Engineer. Alternative construction, lumber or brick veneer. Secretary, Robert Henderson, P. O., Cardale.

Field, Ont.

The contract for plumbing and heating at the church in course of erection here for the Roman Catholic Diocese of Sault Ste. Marie will be let by the Bishop, Rt. Rev. D. J. Scollard, North Bay.

Ford City, Ont.

Tenders on all trades required in alterations to the Parish House will be received until August 15th by the Architects, G. Jacques & Company, 5 Sandwich Street E., Windsor. Frame and brick construction, metal shingle roofing. Approximate cost, $6,000.

Levis, Que.

The Department of Militia, Ottawa, are considering repairs to Fort No. 3. Minister, Hon. S. Hughes, Ottawa.

New Liskeard, Ont.

Work has been commenced by day labor on the erection of a church for the Roman Catholic Congregation. Architect, Charles A. DeLisle, New Liskeard. Estimated cost, $5,000.

Romney Township, Ont.

Tenders are being received for all trades required in the erection of a school in Section No. 6. Architect, S. G. Kinsey, 14 Fifth Street, Chatham.

St. Agathe des Monts, Que.

Tenders on the installation of fittings at the Post Office will be received until 4 p.m., August 9th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications with J. B. Reid, Clerk of Works, St. Agathe, R. L. Deschamps, Overseer, Central Post Office, Montreal, and at the Department, Ottawa. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

St. Thomas, Ont.

Plans for a school to be erected on Yarmouth Heights for the Public School Board are being prepared by J. F. Findlay, 386 Talbot Street. Red brick construction, slate roofing. Approximate cost, $5,500.

Summerside, P. E. I.

Tenders on heating, plumbing and wiring at the addition to the school on Ottawa Street will be received until August 10th. Secretary to the School Board, A. G. Burrows.

Toronto, Ont.

The Property Committee of the Board of Education have approved plans for a six-roomed addition to the John Fisher School, and for a twelve-roomed annex to the Dovercourt School. Tenders will be called shortly. Secretary, W. C. Wilkinson, City Hall.

Tenders will be received until August 10th for the erection of a Public Library at Kew Beach. Architects, Eden Smith & Sons, 199 Yonge Street. Stone and brick construction, slate roofing. Approximate cost, $20,000.

Tenders will be received until August 10th for the erection of a library at Kew Beach and another at Roncesvalles Avenue and Wright Street. Architects, Eden Smith & Sons, 199 Yonge Street. Estimated cost, $20,000 each.

CONTRACTS AWARDED

Aneroid, Sask.

The general contract for the erection of a school for the Consolidated School District has been let to F. Rooney, Third Avenue, Weyburn. Approximate cost, $11,000.

Brantford, Ont.

The contract for plumbing at the Central School has been awarded to R. H. Ballantyne, 3-7 King Street, at $8,000.

East Kildonan, Man.

The contract for alterations and additions to the Municipal Hall has been awarded to C. R. Lay, East Kildonan Road.

Elmira, Ont.

The following contracts have been let in connection with the school erected on William Street:—ceilings, Preston Metal Company, Preston; painting, R. Ruppel, Elmira; electrical work, T. Sherington; interior fittings, Globe Furniture Company, Shantz Avenue, Waterloo.

Fredericton, N. B.

The contract for the installation of a steam heating system at the York Street School has been let by the Board of Trustees to R. Chestnut & Son, Queen Street, at $3,250.

Harrow, Ont.

Henry Holt, Kingsville, has commenced the erection of a school for the Salem School Trustees. The contract for heating has been let to the Kingsville Hardware Company, Main Street, Kingsville. Estimated cost, $4,000.

Hull, Que.

The following contracts have been let in connection with the school in course of erection on Farley Road:—carpentry, Louis Lemieux, Laurier Avenue; plastering, Max Boulay, Hull; painting, E. Jacques, Champlain Street; heating and plumbing, A. Archambault, Box 224; electrical work, Raoul Viau, Notre Dame Street.

Laval des Rapids, Que.

In connection with the novitiate in course of erection for the Christian Brothers, 44 Cote Street, Montreal, the contract for steel work has been let to the Phoenix Bridge & Iron Works, Limited, 83 Colborne Street, the roofing contract to M. Chouinard, 751 Adam Street, and the carpentry contract to E. N. & U. Boileau, 312 Fabre Street, Montreal. Plastering, painting and heating not let.

London, Ont.

The sub-contract for painting at the school in course of erection on Riverview Street has been let to Jolly & Company, 190 Dundas Street.

Matchedash & Tay Townships, Ont.

The general contract for the erection of a school in School Section No. 8 has been let to J. A. Orton, Front Street, Orillia. Approximate cost, $4,500.

Medicine Hat, Alta.

The contract for the installation of fixtures at the Post Office has been let by the Dominion Government Department of Public Works to the Berlin Office & Fixture Company, Limited, 34 Lancaster Street W., Berlin, Ont., at $3,398. Work includes a marble dado.

Montreal, Que.

In connection with the repairs being made at the Court House, the plastering contract has been let to D. Contant, 3160 St. Dominique Street. Painting not let.

The City Council have let the contract for plastering at the Rubinstein Public Baths to the general contractor, A. Archambault, 610 Lafontaine Park, and for electrical work to J. A. St. Armour, 2171 St. Denis Street.

The contract for marble and tile work at the Royal Victoria Hospital, Pine Avenue, has been let to James Walker

Hardware Company, Limited, 252 St. James Street.

Newport, Que.

The contract for metal roofing at the new Roman Catholic Church has been let to L. G. Bilodeau, Trois Pistoles. Contracts for heating, glazing and sculpture work will be let later. Other work will be done by the general contractor.

Pense, Sask.

The Town Council have awarded the general contract for the erection of a Town Hall to Troup & Warner, Pense, at $3,435. Material has been purchased.

Port Dalhousie, Ont.

The Trustees of the Roman Catholic Church have let the following contracts in connection with the school now being built:—masonry and plastering, Newman & Son, 75 St. Paul Street, St. Catharines; carpentry, C. F. Monk, Wilson Street, St. Catharines; painting, Leach & Jones, 46 James Street, St. Catharines; heating and plumbing, O'Gorman & Hemphill, 39 Geneva Street, St. Catharines.

Quebec, Que.

The contract for steel work at the Hospital in course of erection on St. Foye Road for the Bon Pasteur Convent has been let to the Eastern Canada Steel, Limited, 16 St. Peter Street, and for masonry to E. Belanger. Tenders will be called shortly for roofing, plastering, painting, heating, plumbing and electrical work.

Rothesay, N. B.

The Consolidated School Board have let the general contract for the erection of a school to W. H. Henderson, Rothesay, and the masonry contract to James Sproule, 281 Princess Street, St. John, N. B. Estimated cost, $70,000.

Scarboro Junction, Ont.

In connection with the addition to the school in Section No. 10, the contract for heating and plumbing has been let to Paget & Hay, Agincourt. Plastering, painting and iron work not yet awarded.

St. Catharines, Ont.

In connection with the Citadel now being erected on Geneva Street for the Salvation Army, the masonry contract has been let to Rymer Bros., 33 Dacotah Street, and the carpentry contract to C. M. Darker, 92 Welland Street.

Thorold, Ont.

The following contracts have been let for alterations and additions to a school: masonry and plastering, J. Nichol; painting, Grenville Bros., Thorold; carpentry, John Wilson, Merriton, Ont.; heating and lavatories, O'Gormon & Hemphill, 39 Geneva Street, St. Catharines.

Three Rivers, Que.

The general contract for the erection of an addition to the College for the Brothers of the Christian School has been awarded to J. H. Giroux, 8 St. Oliver Street, and the contract for plumbing, heating, metal work and ventilation to Dechene & Company, 106 Des Forges Street. Approximate cost, $75,000.

Valbryant, Que.

The contract for roofing the church now being built has been let to Joseph Guerin, Scott.

Whitby, Ont.

In connection with alterations and additions to a school, the contract for carpentry has been let to the general contractor, Joseph Pearson, Whitby, and for heating and plumbing to J. McIntyre, Whitby.

In connection with the school in course of erection, the general, carpentry, plastering and painting contracts have been awarded to Joseph Pearson, Whitby, and the heating and plumbing contract to J. McIntyre.

Business Buildings and Industrial Plants

Barrie, Ont.

H. D. Minnikin, 227 Elizabeth Street, has commenced razing old buildings on Bayfield Street, preparatory to erecting undertaking parlours and apartments. Estimated cost, $5,000. Owner will do work himself.

Chatham, Ont.

The stores to be erected on William Street for Fred Bates will be built by day labor. Approximate cost, $13,000.

The erection of a shell factory is being considered by the Maritime Foundry Company, Water Street. Estimated cost, $40,000. Manager, Frank McNaught.

Hay Township, Ont.

S. Bell, Blind Line, Hay Township, has commenced the erection of farm buildings, estimated to cost $3,000. Frame construction, concrete and stone foundation, shingle roofing.

Kingston, Ont.

Work has been started by day labor on the erection of a planing and saw mill for S. Anglin & Company, Wellington Street. Approximate cost, $4,000.

La Tuque, Que.

Work has been started by day labor on the erection of a theatre, estimated to cost $10,000. Frame and steel construction. Architect, L. Auger, 36 St. John Street, Levis.

Levis, Que.

Plans for a store and residence to be erected on Commercial Street for Charles Gastonguay are being prepared by Talbot & Dionne, 14 St. Joseph Street, Quebec. Estimated cost, $6,000.

Molesworth, Que.

The Makamik Sawmill Company, Makamik, Que., have commenced the erection of a sawmill, estimated to cost $6,000. Work by day labor.

Montreal, Que.

Work has been started on the erection of a store at 41 McGill College Avenue by L. P. Mathys, 333 Viger Avenue. Approximate cost, $4,000.

Prince Albert, Sask.

Plans are being prepared for two stores to be erected on Central Avenue for H. B. Boyes, 1756 Nelson Street, Vancouver, B. C. Architect, J. M. Morrison, Masonic Temple.

Quebec, Que.

Tenders will be called for shortly on the erection of a grand stand on the Exhibition grounds. Architects, Tanguay & Lebon, 20 d'Aguillon Street. Approximate cost, $25,000.

Regina, Sask.

Tenders are being received on the erection of an office and warehouse building for the Robert Simpson Company, Queen and Yonge Street, Toronto, Ont. Concrete, brick and steel construction. Estimated cost, $150,000.

Toronto, Ont.

Plans have been drawn for a warehouse on Symes Road for Gunns Limited, Gunns Road, at an estimated cost of $6,000. Corrugated iron construction. Work by day labor.

Usborne Township, Ont.

S. Hicks, Exeter, Ont., is erecting farm buildings, estimated to cost $3,000. Brick construction, stone and concrete foundation, shingle roofing.

Welland, Ont.

S. L. Lambert, 56 Main Street N., has commenced the erection of a wholesale grocery warehouse, estimated to cost $10,000. All work will be done by owner.

CONTRACTS AWARDED

Brantford, Ont.

The following contract have been let for the erection of a store at Colborne and Queen Streets for the Brethour Estate:—general contract, tile and concrete work, Schultz Bros. & Company, Limited, Albion Street; ornamental iron work, Canada Wire & Iron Company, Limited, Hamilton; steel, Hamilton Bridge Works, Hamilton; roofing, Turnbull & Cutliffe Company, 50 Colborne Street.

Dorval, Que.

The Dorval Jockey Club have let the contract for the erection of a betting booth at the Race Track to Louis Beaudry, 2420 Hutchison Street. Approximate cost, $6,000.

Hamilton, Ont.

The following contracts have been let for the erection of a factory on Burlington Street for the Dominion Steel Metal Company, Lister Building:—masonry, Brayley & Nicholson, 155 Gibson Avenue; steel, Hamilton Bridge Works, Bay Street; roofing, Thomas Drouin & Son, 22 McNab Street. Other work will be done by owners.

The contract for plumbing at the warehouse in course of erection at 73 Robert Street for Takefman & Goldblatt has been awarded to the Clyde Plumbing Company, 196 York Street. Roofing, painting and electrical work will be done by the general contractor, M. Levy, 215 Park Street W.

The contract for foundations for the factory to be built on Hughson Street for the T. Eaton Company has been let to Christman & Company, Hamilton, and for the steel work to the Hamilton Bridge Company. Tenders have been received for all other trades. Estimated cost, $150,000.

Montreal, Que.

The general contract for alterations and additions to the factory of the Canadian Consolidated Rubber Company, 950 Notre Dame Street E., has been let to G. M. Martin & Company, 399 Decarie Boulevard. Work has been commenced. Stone construction, concrete foundation, felt and gravel roofing.

The following contracts have been let in connection with the stables in course of erection for J. M. Aird, 165 St. Urbain Street:—metal sash, Steel & Radiation Limited, 304 University St.; stable fittings, Beatty Bros., St. George Street, Fergus, Ont.; heating, General Fire Extinguisher Company, 374 Beaumont Avenue; electrical work, Montreal

Electric Company, Limited, 425 St. James Street.

Quebec, Que.
In connection with the station in course of erection on St. Peter Street, the contract for painting has been let to O. Lachance, 25 Eden Street, Levis, and for electrical work to Vandry & Matte, St. John Street, Quebec. Plastering not let.

Red Deer, Alta.
The general contract for the erection of a grocery warehouse for Nash Bros., Minneapolis, Minn., has been let to Baird & McKenzie, North Red River. Approximate cost, $14,200.

St. Catharines, Ont.
The Nash Realty Company, St. Paul Street, have let a contract for the erection of stores on Queen Street to F. Hoare. Estimated cost, $8,000.

A contract for the erection of a number of stores on Queen Street has been let by A. E. Nicholson, Queen Street, to Newman Bros., 75 St. Paul Street. Approximate cost, $9,500.

In connection with the picture theatre being built on James Street for J. & J. Sullivan, Church Street, the masonry and carpentry contracts have been let to Newman Bros., 75 St. Paul Street, the contract for painting to Leach & Jones, 46 James Street, and for heating and plumbing to O'Gorman & Hemphill, 39 Geneva Street.

Timmins, Ont.
F. W. Reed, Timmins, will receive tenders until August 10th for heating and plumbing in connection with the business block in course of erection. Architects, Angus & Angus, Angus Block, North Bay.

Toronto, Ont.
In connection with the office building in course of erection on University Avenue for the Provincial Hydro-Electric Commissioners the heating contract has been let to the G. E. B. Grinter Company, Limited, 26 West Market Square, Guelph.

A. M. Chapman, 176 Danforth Avenue, is building a garage, and has let the contract for steel work to McGregor & McIntyre, Shaw Street. Approximate cost, $5,000.

H. T. Hunter, 79 Adelaide Street E., has let the contract for the construction of a garage to R. Cummings, 1002 Lumsden Building. Brick construction, felt and gravel roofing. Estimated cost $5,000.

Walkerville, Ont.
Work has been started on the erection of a factory for the Dominion Stamping Company. The contract for steel work and roofing has been let to the Canadian Bridge Company, Walkerville, and the painting contract to C. M. Bennett.

Winnipeg, Man.
The general contract for alterations and additions to the Criterion Hotel has been let to the Standard Construction Company, 1004 Union Trust Building. Estimated cost, $5,000.

The following contracts have been let in connection with the business block in course of erection at Portage and Garry Streets for Leon Honnorat:—ornamental iron and steel work, Western Steel & Iron Company, Limited, Elmwood; roofing, Metal Shingle & Siding Company of Manitoba, Limited, 677 Notre Dame Avenue; marble and tile work, Missisquoi Lantz Company, Limited, 726 Somerset Building; elevator, Gurney Elevator Company.

Residences

Barrie, Ont.
W. C. Thompson, 15 Owen Street, has prepared plans for a residence to be erected on Bradford Street, at an approximate cost of $4,000.

Work on the erection of a residence on Toronto Street has been commenced by W. C. Thompson, 15 Owen Street. Estimated cost, $3,000.

Halifax, N. S.
Plans are being prepared for a residence to be erected on Lilac Street by the Eastern Investment Corporation, Cragg Building, Barrington Street. Tenders for heating, plumbing and electrical work will be called shortly. Approximate cost, $6,000.

Work has been started on the erection of a residence on Jennings Street and of another on Vernon Street by the Eastern Investment Corporation, Cragg Building, Barrington Street. Estimated cost, $5,000 and $6,000 respectively.

Hamilton, Ont.
Tenders will be called shortly on the erection of a residence on Markland Street for J. Sifton, City Hall. Estimated cost, $8,000. Architects, Watt & Blackwell, Lister Chambers.

Plans have been drawn for two residences to be built on Analon Place by MacKay Bros., Lister Building. Brick construction, concrete foundation, shingle roofing. Approximate cost, $2,200 each.

MacKay Bros., Lister Building, have had plans prepared for a residence to be erected on St. Clair Avenue at an estimated cost of $3,000. Contracts will be let for plastering, painting, heating, plumbing and electrical work.

Hensall, Ont.
The erection of a residence is being considered by Alexander Buchanan. Frame and white brick construction. Estimated cost, $3,200.

Levis, Que.
Joseph Leblond, Commercial Street, is building a residence and drug store at Commercial and Fraser Streets by day labor. Approximate cost, $8,000.

Montreal, Que.
Ernest Pepin, 129 Marlowe Street, has commenced the erection of a residence estimated to cost $4,000.

Work has been started on the erection of three flats by George Smith, 519 Papineau Avenue. Estimated cost, $6,500.

North Bay, Ont.
Adam Torrance, 26 Second Avenue E., is receiving tenders on the erection of a residence on Bloem Street. Architects, Angus & Angus, Angus Block. Artificial stone and brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,500.

Ottawa, Ont.
Plans of five residences to be built on Melrose Street are being prepared by Foster & Marks, 11 Irving Avenue. Brick construction, stone foundation, felt and gravel roofing. Approximate cost, $8,000.

Work has been commenced by John Wilson, Wellington Street, on the erection of a residence on Bethany Street, at an approximate cost of $5,000. Brick veneer construction, stone foundation, shingle roofing.

Toronto, Ont.
Tenders are now open for the erection of a number of houses in the East End for the Reliance Building Corporation, 70 King Street E. Plans and specifications with the Architect, W. H. Martin, 70 King Street E.

R. Liddell, 155 Lippincott Street, has had plans prepared for a pair of residences estimated to cost $4,800. Brick construction, shingle, felt and gravel roofing.

In connection with the residences being built on Coleman Street by J. Stanhope, 62 Balfour Street, tenders are being received on heating, plastering, electrical work and painting.

The contract for plumbing at the residences in course of erection on Coleman Street for J. Stanhope, 62 Balfour Street, has been let to George Youlet, 261 Booth Avenue.

Work has been commenced on the erection of a residence at 15 Ingham Avenue for F. Hedges, 17 Ingham Avenue. Smaller trades will be let. Brick construction, shingle roofing. Estimated cost, $5,000.

Plans have been drawn for a residence to be built on Garden Avenue by J. D. Naylor, 110 Glenholme Street, at an estimated cost of $3,500. Smaller trades will be let. Brick construction, shingle roofing.

J. McCallum, 150 Cortleigh Boulevard, has had plans prepared for a residence, estimated to cost $3,000. Brick construction, shingle roofing.

Tenders on the installation of plumbing and sanitary conveniences in a number of houses will be received until August 17th by the Board of Control. Plans at office of the Health Department, City Hall.

CONTRACTS AWARDED

Aylmer, Ont.
The contract for the construction of a residence for Mrs. White has been let to C. M. Smith. Approximate cost, $3,500.

Centreville, Ont.
Work has been commenced on the erection of a residence for the Principal of the Public School, William Fenton. The contract for masonry has been let to George Rath, Preston.

Galt, Ont.
The Getty & Scott Shoe Company, 109 Water Street N., have let the general contract for the erection of an addition to their factory to Thomas Hancock, Galt. White brick construction.

Guelph, Ont.
In connection with the residence built on College Heights for Miss M. E. Murdock, the contract for carpentry has been let to D. Scroggie, care of E. A. Mahoney, Telephone Building.

Halifax, N. S.
In connection with the residences erected on Vernon and LeMarchant Streets for the Eastern Investment Corporation, Cragg Building, Barrington Street, the heating contracts have been let to Longard Bros., 213 Hollis Street, the contract for plumbing to W. S.

Craigg, 316 Upper Water Street, and for electrical work to J. Starrs Son & Company, Limited, Granville Street.

The following contracts have been let in connection with the flats in course of erection on LeMarchant Street for G. F. King, Francklyn Street:—masonry and carpentry, J. W. Keddy, 138 Cunard St.; roofing, W. McFateridge, Water Street; plastering, J. Foley, 29 Allen Street; painting, David Roche, 238 Argyle St.; heating and plumbing, G. H. Kinsman, 72 Cornwallis Street; electrical work, John Starr, Son & Company, Limited, Granville Street; interior fittings, J. W. Keddy, 138 Cunard Street.

Hamilton, Ont.

The general, masonry, carpentry and roofing contracts for the erection of a residence for E. Condon, 61 Leeming Street, have been awarded to C. G. Hudson, 10 Edinburgh Street. Approximate cost, $3,500.

Plans have been prepared for a residence to be erected on Kensington Avenue for E. Condon, 61 Leeming Street. The general, carpentry and roofing contracts have been awarded to C. G. Hudson, 10 Edinburgh Street, the contract for masonry to Klingbell & Jevons, 22 Rosemount Street, and for heating and plumbing to H. Barnes, 23 Fife Street. Estimated cost, $3,500.

Inglewood, Ont.

The following contracts have been awarded in connection with the residence in course of erection for J. M. Scott:—brick work and plastering, J. Hunt, Inglewood; carpentry, J. Daytons, Inglewood; heating, A. Sprat & Sons, Inglewood.

Levis, Que.

In connection with the residence in course of erection on Wolfe Street for Joseph Samson, the masonry, carpentry, roofing and plastering contracts have been let to the general contractor, J. Blais, Levis, the painting contract to M. Guay, 50 Carrier Street, and the heating, plumbing and electrical contracts to J. B. A. Lachance, 392 St. Francois Street, Quebec.

Montreal, Que.

The following contracts have been let for the erection of a residence at 25 Fairmount Street E., for the School Board of Infant Jesu Parish:—general contract, masonry and carpentry, E. A. D. Boileau, 1485 St. Andre Street; steel, Structural Steel Company, Limited, New Birks Building; roofing, M. Chouinard, 751 Adam Street; painting, Antoine Lussier; heating and plumbing, N. Ouellette & Fils, 719 Colonial Avenue; electrical work, J. A. St. Amour, 2171 St. Denis Street. Plastering not let.

In connection with the residence built at Grosvenor Street and Westmount Boulevard for the Estate of Jonathan Brown, 1050 Dorchester Street W., the roofing contract has been let to Richardson, Simard & Company, 745 Clarke St., the heating and plumbing contract to Hickey & Aubut, 93 Dominion Street, the contract for tiling to the Walker Hardware Company, Limited, 252 St. James Street, and for plastering to A. K. Hutchison, New Birks Building.

Ottawa, Ont.

E. W. Foster, 80 Spadina Avenue, has let the following contracts in connection with the residence in course of erection on Carruthers Street:—plastering, H. Lethbridge, Westboro; heating, J. Cameron, 488 Lewis Street; plumbing, W. Lethbridge, First Avenue; electrical work, Dominion Electric Construction Company, 417 Sparks Street.

Work has been started on the erection of a residence on Murray Street for A. Levinson, 217 Somerset Street. The contract for plastering has been let to Peter Boply, Heney Street, the heating and plumbing contract to J. T. Blyth, Frank Street, and the wiring contract to the Rideau Electric Company, 128 Bank St.

In connection with the residence being built on Allan Street by James Brownlee, 11 Clemow Avenue, the contract for heating and plumbing has been let to J. Gervin, Bank and Sunnyside Streets, and for electrical work to H. L. Allan, 377 Somerset Street.

Work has been commenced on the erection of a residence on Sunnyside St. for B. A. Grison, 89 Fentiman Street. The contract for heating and plumbing has been let to J. P. Band, 775 Bank St., and for electrical work to H. L. Allan, 377 Somerset Street.

Quebec, Que.

In connection with the residence erected for Eugene Dube, 163 St. Olivier St., the roofing contract has been let to O. Barbeau, 154 Franklin Street, the contract for painting to J. M. Tardivel, 4 Abraham Hill, and for heating, plumbing and electrical work to E. T. Moreau, 176 Abraham Hill.

In connection with the residence being built on Aberdeen Street by Leon Nadeau, 105 Franklin Street, the roofing contract has been awarded to O. Barbeau, 154 Franklin Street, the contract for plastering to J. B. Verret & Fils, 190 Third Avenue, Limoilou, and for heating, plumbing and electrical work to R. Chiquette, 210 Queen Street.

Raleigh Township, Ont.

In connection with the residence erected for J. B. Rhodes, Chatham, P. Q., the contract for plastering has been let to Celesta Blond, 178 St. Joseph Street, Chatham, the heating, plumbing and electrical contracts to Robert Mitchell, 185 King Street W., Chatham, and the painting contract to Fred Phelps, 7 Linden Street, Chatham.

St. Catharines, Ont.

The general contract for the erection of a residence for F. N. Hara, College Street, has been let to Newman Bros., 75 St. Paul Street, the carpentry contract to C. F. Monk, Wilson Street, and the painting contract to Leach & Jones, 46 James Street. Approximate cost, $12,000.

St. Hyacinthe, Que.

The following contracts have been let in connection with the residence in course of erection on Girais Street for J. A. Boisseau:—masonry, J. P. Desjardins; roofing and ventilating, Daniel & St. Jean, 236 Cascades Street; painting and glazing, Jules Gingras, 80 Cascades Street; heating and plumbing, A. Blondin & Cie, 115 Cascades Street; plastering, A. Blanchard; fire escapes, Montreal Architectural Iron Works Company, 157 Prince Street, Montreal. Tile work not let.

Stratford, Ont.

In connection with the residence in course of erection at 26 Centre Street for G. F. Heideman, City Hall, the following contracts have been let:—general and carpentry, G. Faulk, 197 Hibernia Street; masonry, Harry Thorne, Avondale and Huron Streets; plastering, W.Soeder, 210 Huron Street; heating, McDonald & Henry, 11 Ontario Street; plumbing, Classic Sanitary & Heating Company, 164 St. Patrick; electrical work, Bennington & Young, 110 Ontario Street.

Toronto, Ont.

In connection with the residences built on Langford Avenue by Holmes & Anderson, 275 Jones Avenue, the plumbing contract has been let to R. J. Ritchie, 851 Logan Avenue, and the plastering contract to White Bros., 55 Hunter St.

A residence is being built at 94 Neville Park Boulevard by H. B. Jackson, 323 Beech Avenue, at an estimated cost of $4,000. Smaller trades will be sub-let. Owner's name withheld.

The contract for plastering at the residence in course of erection on Pine Crescent for J. A. Stewart, 81 Wheeler Avenue has been let to Halwell & Kilsby, 41 Pickering Street, and the plumbing and heating contract to Stratton & Cork, 314 Lee Avenue.

In connection with the residence built at 60 Neville Park Boulevard by A. Crawford, the heating, plumbing and electrical contracts have been let to Hillier & Company, 2199 Queen Street E., the contract for plastering to T. Wilay, 4 Elmer Avenue, and for painting to G. R. Stacey, 130 Mutual Street.

The following contracts have been awarded in connection with the apartments built by A. McLeod, 47 Benalmond Street:—plumbing, E. R. Restall, 90 Scarborough Road; heating, S. W. Schulkins, 932 College Street; electrical work, G. H. Armor, 21 Ferndale Avenue; plastering, H. Hill, 16 Lawlor Avenue.

E. Churchill, 3 Orchard Boulevard, is erecting a residence at 10 Neville Park Boulevard for N. E. Shier, 900 Queen Street E. The contract for plastering has been awarded to W. Churchill, 42 Edgewood Avenue. Approximate cost, $5,000.

Power Plants, Electricity and Telephones

Ailsa Craig, Ont.

The hydro-electric system will be installed by the Hydro-Electric Commission of Ontario, Continental Life Building, Toronto. Engineer, J. H. Castor. Approximate cost, $7,728.

Athens, Ont.

The installation of an electric light and power system is contemplated by the Town Council. Clerk, A. M. Lee.

British Columbia Province

The British Columbia Telephone Company, 555 Seymour Street, Vancouver, have commenced extensions to their system in the Lower Fraser Valley. Approximate cost, $70,000.

Elizabethtown Township, Ont.

The electric lighting system is being installed by the Electric Commission. Manager, E. J. Phillips. Approximate cost, $6,000.

Harriston, Ont.

A by-law has been carried providing for the installation of a hydro-electric

Tenders and For Sale Department

TENDERS

Sealed tenders will be received by the undersigned up to noon on **Monday, August 16th**, for the construction of a Municipal Drain in the Township of Minto, known as Drain No. 6.

The drain is about 16,000 feet long and contains approximately 12,500 yards of excavation.

Profile and specifications can be seen at the office of the undersigned.

The lowest or any tender not necessarily accepted.

W. D. McLELLAN,
Clerk of Minto.

31-32

Bridge Notice

Sealed tenders marked Tender for Dismantling the St. John Suspension Bridge will be received at the New Brunswick Provincial Department of Public Works, Fredericton, until **Wednesday, 18th day of August, 1915**, at noon, for dismantling the old "Suspension Bridge" at St. John, N. B., according to Specifications to be seen at the following: Provincial Department of Public Works, Fredericton, N. B., Provincial Government Rooms, St. John, N. B., the offices of the Structural Engineering Company, Limited, 503 to 507 New Birks Building, Montreal, P. Q.

Each tender must be accompanied by a certified Bank Cheque or Cash for an amount equal to five per cent. of the tender, which will be forfeited if the party tendering declines to enter into contract when called upon. Such certified Bank Cheque or Cash will be returned to the parties whose tenders are not accepted, but with the party to whom the contract is awarded, it shall be retained until the final completion of the contract and its acceptance by the Department. Not obliged to accept lowest or any tender.

JOHN MORRISSY,
Minister of Public Works.

Department of Public Works,
Fredericton, N.B., July 29th, 1915.

31

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board will be received until

Tuesday, August 17th, 1915

For All Trades

For Enlargement of Eglinton Public School on Eglinton Avenue

Also

Heat Regulators and Sundry Trades in other Schools

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by surety companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

MILES VOKES,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer.

31

WANTED

Double deck iron cars, suitable for drying bricks in tunnels. Apply Box No. 224, Contract Record, Toronto.

30-31

CITY OF REGINA

Waterworks Department

Sealed tenders will be received by the City Commissioners up till noon, **Monday, September 6th, 1915**, for the supply, delivery and erection of a 7,000,000 gallon Pumping unit at the City Power House, Regina, Sask.

Specifications and other information may be obtained from the office of the undersigned. The City does not bind itself to accept the lowest or any tender.

J. M. MACKAY,
Superintendent of Waterworks.

July 22nd, 1915.

30-31

COUNTY OF BRANT

Sealed tenders clearly endorsed on the outside "Tender for Puttown Bridge Abutments," will be received by the Counties of Oxford and Brant up to 12 o'clock noon, on **Saturday, August 14th, 1915**, addressed to the County Clerk, County Building, Brantford.

(a) For Reinforced Concrete Abutments,
and alternatively

(b) For Solid Concrete Abutments.

Tenders for either class must be on the prescribed forms and accompanied by a marked cheque for 5 per cent. of the amount of the tender made payable to the Treasurer of the County of Brant. Plans and specifications may be seen at the office of the County Engineer, from whom tender forms may be had, Room 4 Temple Building, Brantford.

ALAN MAIR JACKSON,
County Engineer.

31-32

Tenders for Wrecking Buildings

Sealed tenders will be received, addressed to the Chairman of the Finance Committee, City Buildings, St. Catharines, up to 5 o'clock p.m. of **Tuesday, August 24th, 1915**, for the wrecking and removal of the following buildings on the right-of-way to the St. Paul Street Bridge.

3 Blocks of Brick Stores.
2 Brick Residences.
1 Large Stone Residence.
Barns and Sheds.

An alternative tender will also be received for the salvage of the lot of the I. O. O. F. property, together with their building.

Specifications and information regarding the work may be obtained at the office of the City Engineer.

Tenders will be received for each building separately or for all in bulk. A marked cheque for Fifty dollars must accompany each tender. The City does not bind itself to accept the highest or any tender.

W. P. NEAR,
City Engineer.

31-32

Paving Tenders

Sealed tenders addressed to the undersigned will be received up to 8 o'clock p.m., **August 9th, 1915**, for paving Canal Street East, Dunnville, Ont., with either Rocmac, Tarvia, Westrumite or Oil Bound Macadam. Contractors will please submit specifications, and the Council reserves the right to select the paving most suitable.

Plans may be seen at the Town Engineer's Office on and after August 2nd, 1915.

No tender necessarily accepted.

J. W. HOLMES,
Town Clerk.

31

Power Plants, Electricity and Telephones

(Continued from page 53)

system. Town Engineer, John Patterson.

Saskatchewan Province

The following rural telephone companies have been authorized to borrow money for the construction of their systems:—Cut Knife, $12,000, Secretary, W. W. Johnston, Cut Knife; Ernscliffe, $6,000, J. F. Middlemiss, Wolseley; Glenrose, $10,000, R. J. Howard, Glenrose; Hielier, $12,000, R. Howe, Stoughton; Kansas, $6,000, J. R. Funk, Drake; Lockwood, $10,000, M. H. Waldron, Lockwood; Lovat, $2,500, A. Parley, Lovat; Mair, $9,000, J. C. Clark, Mair; Montgomery, $4,500, C. A. Ingham, Kennedy; Narrow Lake, $14,000, M. J. Stephenson, Wilkie; North Redvers, $11,000, G. M. McKenzie, Redvers; O. K., $3,500, H. McManus, Colgate; Paswegin, $3,500, F. Gillespie, Paswegin; Renown, $5,500, G. McKay, Renown; River Ayr, $25,000, J. N. R. Finlayson, Broadview; Ruddell, $5,600, A. E. Steele, Ruddell.

Windsor, Ont.

The City Council are about to call for tenders on the supply of about five miles of copper wire. Clerk, S. Lusted.

CONTRACTS AWARDED

Glenrose, Sask.

The Glenrose Rural Telephone Company, Limited, have let the contract for the construction of their system to Harold Herbert, North Battleford, at $9,350. Contractor is in the market for material for about 44 miles of line.

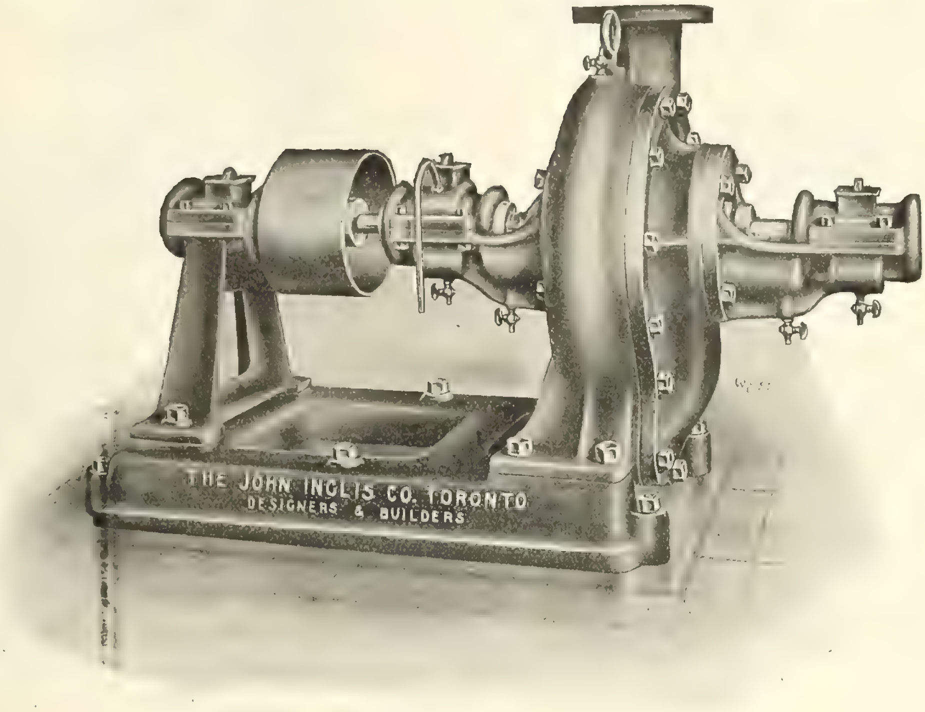
Montreal, Que.

The contract for the supply of underground cable for the Filtration Plant has been let by the Board of Control to the Northern Electric Company, Limited, 814 Notre Dame Street West.

Casement Contracts

Messrs. B. & S. H. Thompson & Company, Limited, of Montreal, representing the Crittall Casement Company, have secured the contracts for the solid steel casements for the new Montreal Civic Library, and also for the Ross Pavilion of the Royal Victoria Hospital in Montreal.

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

INGLIS' PRODUCTS ARE "MADE IN CANADA"

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Save 50% on Stone Sawing

Anderson "Diamond Reinforced" Saw Tooth

After costly experimenting, we have produced a Saw Tooth which enables diamond saw owners to reduce their cutting (independent of labour) by 50 per cent.

This Tooth is the "ANDERSON REINFORCED DIAMOND SAW TOOTH."

This Tooth contains, instead of one solid diamond, a number of small pieces making up the same weight. The double advantage being that it COSTS LESS and LASTS LONGER.

With the Reinforced Diamond Tooth the diamond is inserted in a broken condition, and perfectly reinforced with steel. As the tooth wears down only small pieces can go to waste, mere dust, and it is impossible for them to suffer loss through entire or partial breakage so common with teeth cutting the harder building stones.

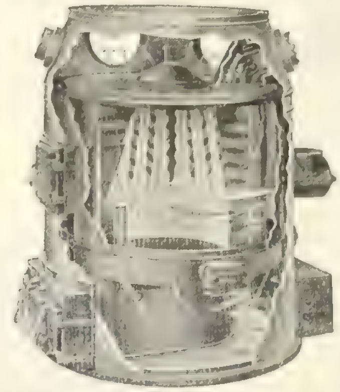
When the first layer of the small pieces have done their work and are worn away, the second layer comes into cutting action, and so on, until the teeth are worn out.

Write us for prices.

Geo. Anderson & Co.
of Canada Limited
QUEBEC BANK BUILDING,
MONTREAL

KELSEY

Warm-Air Generator



The "Kelsey" antiquates all other methods of healthful heating. The "Kelsey" supplies warmed fresh air and **not** re-heated foul air like steam and hot water systems. For school and office buildings it is the ideal method because it furnishes a stimulating healthful atmosphere.

Write for our literature

The James Smart Mfg. Co.
Limited
Brockville, Ont.

The Baby Ford Meter Testing Machine

The Ford "Baby" gives you the same means of rapidly and accurately testing your water meters as the Standard Ford.

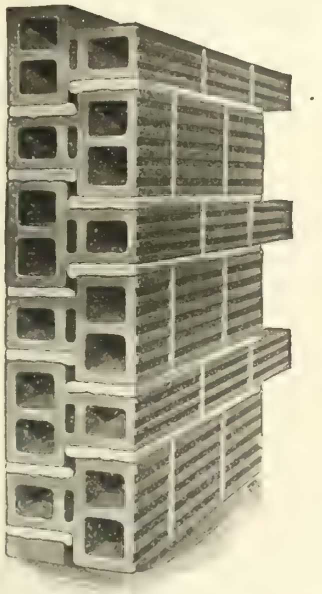
The quality of workmanship and material are of the same high grade—but the price is only $45.

You can't afford to be without a "Baby" Ford at this price. We will be glad to give you details about this convenient one-meter testing machine.

Write us for the bulletin—to-day.

The Ford Meter Box Co.
Wabash, Ind.

Denison Interlocking Hollow Tile Assures "Safety First" in Building



Eight Inch Wall
Builds like a Thermos Bottle

Safety in construction because of its bonding and interlocking features which are unequalled by any other tile.

Safety in a healthful way because no moisture can seep in. There are no mortar joints extending through the wall.

Safety in the matter of heating for the dead air spaces insulate it against heat and cold.

Safety in fireproof features.

Canadian builders should specify Denison Interlocking Hollow Tile because it's well made in Toronto, Canada.

Twelve Inch Wall
Builds like a Thermos Bottle.

SUN BRICK CO., Limited

The One Price Company

Traders Bank Building **TORONTO, ONT.**

Montreal Agent : **HYDE & SONS, LIMITED**
12 Bleury St.

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.

Turnbull Elevators

Passenger
Freight
Hand Power
Dumb Waiters

The Turnbull Elevator
Mfg. Company
TORONTO, ONT.

TRINIDAD LAKE ASPHALT

Is Oleomargarine Butter?

Is "rubber" made from cornstalks really rubber? Is "silk" made from wood fibre really silk? None of these things equal the natural products man tries to imitate.

Neither do man-made asphalts equal the natural lake asphalt—Trinidad.

Manufactured asphalts are for the first time exposed to the elements when they are put into a pavement or road. Natural lake asphalt has passed through and survived these destructive influences in the course of its age-long tropical formation.

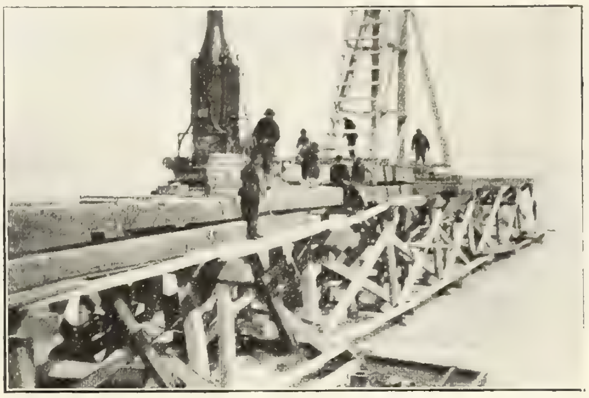
Besides this, Trinidad has a record of service covering 30 years and including 200,000,000 yards of pavements.

Facts—not merely our say-so—as to the superior durability of Trinidad pavements are contained in a book entitled "Evidence" which will be sent free to any one interested in getting the most in paving for the money expended.

The Barber Asphalt Paving Co.

Philadelphia, Pa.

MARSH AND HENTHORN MODERN HOISTING MACHINERY



M & H Hoisting Engine driving Piles in Harbor at Port Weller, Ont.

Standard Machines in stock. Prompt shipments.
Prices moderate

Marsh & Henthorn, Limited
Belleville, Ontario

Sales Agents: Mussens Ltd, Montreal

Goold, Shapley & Muir Co.
Limited

Brantford Winnipeg Regina Calgary

Towers and Tanks for all purposes.

Concrete Mixers

Gas and Gasoline Engines

Hoists

Windmills

Water supply outfits of every description.

CORRESPONDENCE SOLICITED

Warehouse Space To Let

5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally located at Adelaide and Charlotte Streets.
Light on four sides
Passenger and freight elevator
Vaults
One block from four car lines
Floor area 6,300 sq. feet, each floor.

For further particulars ask

Hugh C. MacLean, Limited
347 Adelaide St. West, Toronto
Phone Adelaide 2700

BOOKS

For

Engineers and Contractors

The following Books are Offered subject to Previous Sale:

British & Foreign Building Stones, by John Watson, Published in 1911 at the University Press, Cambridge, England. 483 pages. Price 50 cents.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

Contract Record
347 Adelaide St. West, Toronto, Ont.

CHELSEA
EXEMPLAR OF QUALITY
DUMBWAITERS

A double automatic Brake Dumbwaiter
Automatic two ways. UP and DOWN.
Patented in Canada

We want live representatives everywhere in Canada.
Write us for particulars.

Chelsea Elevator Company
332 West 26 St., N.Y. City, U.S.A.

MADE IN CANADA

STANDARD
Wires and Cables

Bare Copper, Brass and Bronze Wires
STANDARD C. C. C. Wire (Colonial Copper Clad)
Weatherproof Wire, Rubber Insulated Wire
Varnished Cloth Cables (Varnished Cambric)
Fibre, Paper and Rubber Leaded Cables
Armored Cables of all kinds
Cable Terminals, Junction Boxes, etc.

For further information write our nearest office.

Standard Underground Cable Co. of Canada, Limited
Hamilton, Ont.
Montreal, Que. Winnipeg, Man. Seattle, Wash.

Handling Garbage at Low Cost

The Ideal Incinerator plant at Berlin is handling garbage quickly and in the most up-to-date way at low cost.

The Ideal High Temperature Destructor consumed 15 tons of garbage in 8 hours and 1 horse weight 1385 in 20 minutes. The plant has a capacity of 30 tons daily and is fire proof.
We will be glad to supply you with plans and data for similar work. Write for information.

Ideal Incinerator & Contracting Company
No. 2 Manning Arcade Annex, Toronto

"Hammer Brand"
Hard Wall Plaster

HARD-WALL PLASTER HAMMER BRAND HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

Albert Manufacturing Co.
Hillsborough, New Brunswick, Canada

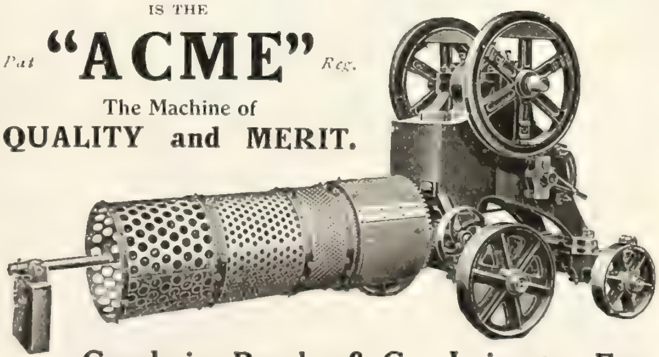
Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

This STONE CRUSHER
IS THE
Pat. "ACME" Reg.
The Machine of
QUALITY and MERIT.



Goodwin, Barsby & Co., Leicester, Eng.

MITCHELL CRUSHER MANUFACTURING CO. LTD

MITCHELL CRUSHER

For Stone and Ore

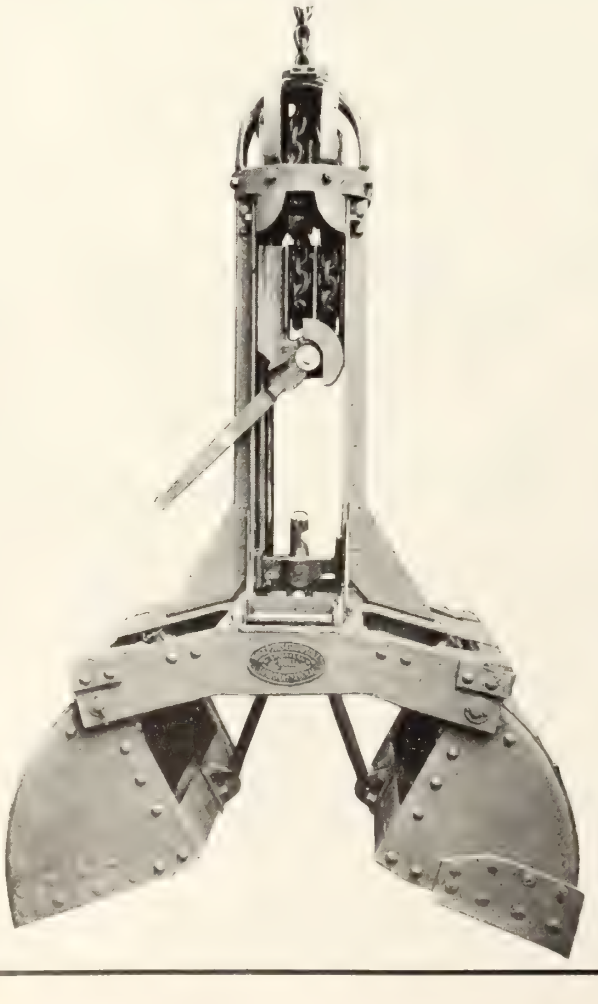
We manufacture a complete line of crushers. Also crushing equipment for quarries, mines, contractors and builders.

Mitchell crushers are sturdily built to crush the hardest materials.

Get our prices.

Woodstock Concrete Machinery Co.

Woodstock, Ont.



"Kingston" Single Chain Grabs

The plain edge model is made to lift small coal, grain, mud and other loose material.

The toothed model is for lifting rock, large coal, ballast, etc.

Made in 7 sizes to handle from ½ to 2 cubic yards.

Quick-working 4 to 1 leverage.

Cut Your Operating Costs

Manufactured by

Rose, Downs & Thompson, Ltd.
HULL, ENGLAND

Designers and Manufacturers of
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The R. E. CLEATON CO.
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We design, furnish machinery for, and build complete

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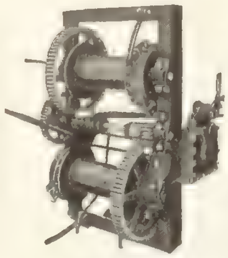

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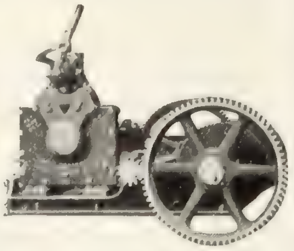

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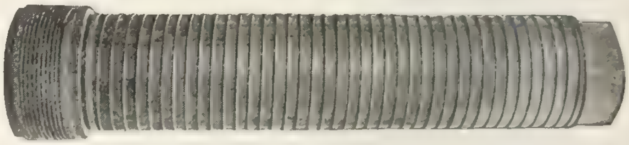

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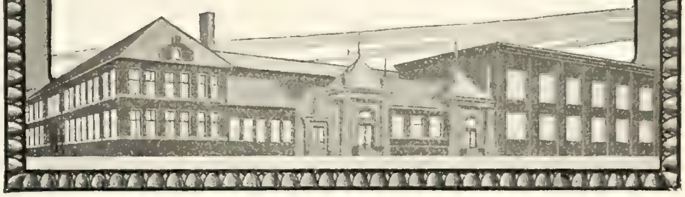

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Ontario Wind Engine & Pump Co.

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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12 in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.75; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. net cash. Copper bearing sheets—Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13½c basis; African hemp, 13½c.; sisal rope, 11½c. basis; lath yarn, 10¼c. Boiled linseed oil—in barrels, 72½c. per gal. of 9 lbs. Raw linseed oil in barrels, 70c. per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20. Bags 10 cents extra.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, ship-lap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots. f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

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"Pillar Brand"
Hardwall Plaster

"Pillar Brand" hardwall plaster is made from the purest Nova Scotia Rock, calcined and prepared by expert workmen under experienced supervision.

"Pillar Brand" plaster is mixed with the highest grade goat and cattle hair, thoroughly washed and specially prepared.

We also make cement plaster, whitewall finish, plaster of paris, and land plaster. Shipments by rail or water.

Write us for prices.

The Iona Gypsum Co., Limited

Head Office, Sydney, N. S. *Mills,* Iona, N. S.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 66

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $11.50 per 100 lbs.; boiled linseed oil, in bbls., 98 cents per gal.; raw linseed oil, in bbls., 95 cents per gal.; dry red lead, $10.00 per 100 lbs.; putty in bulk, $3.25 per bbl.; putty in 25-lb. tins, $3.75; turpentine, in bbls., 80 cents per gal. Mixed paint, ordinary colors, per gal., $3.10.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 350 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $9.00 f.o.b. warehouse. $9.00 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse, pressed buff brick $40 at warehouse; $33 in car lots; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35 in car lots, $40 in warehouse; fire clay, $12 per ton in car lots.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.25 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galavanized iron—28 gauge, $5.75 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.00 in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal., $2.75 to $3.25.

White lead—ground in oil, $11.50 to $12.50 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

Spruce Dimension

in any sizes up to 12-in. and in any lengths up to 30-ft.

Also Random lengths in plank and timber.

Spruce treated by the Kyanizing process to preserve it from decay a specialty.

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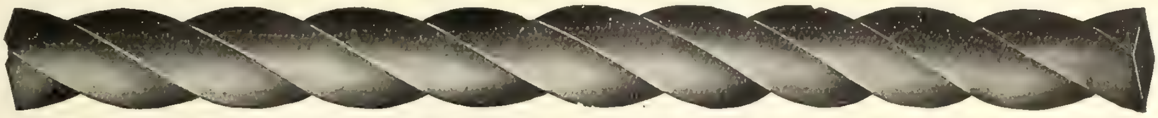

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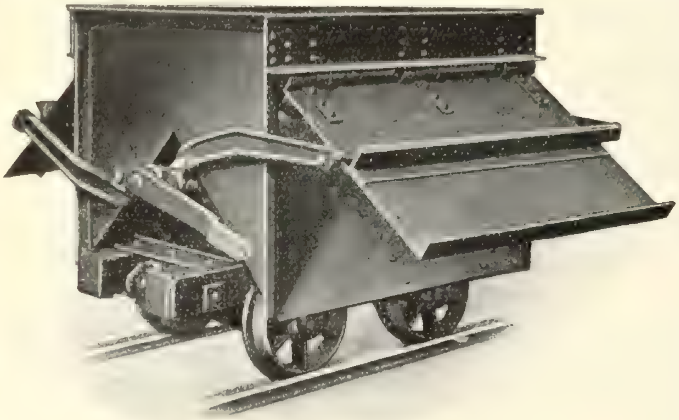

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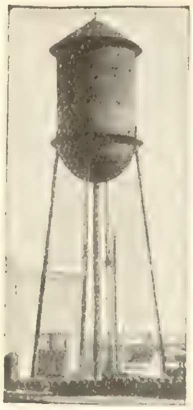

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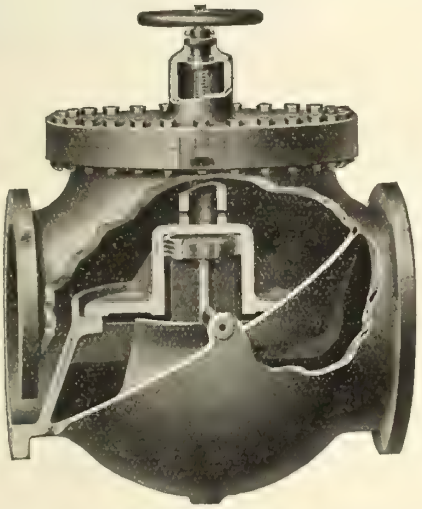

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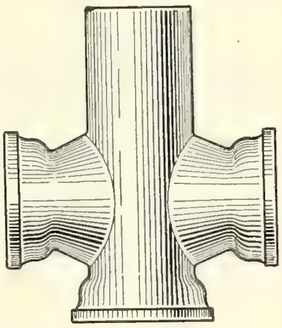

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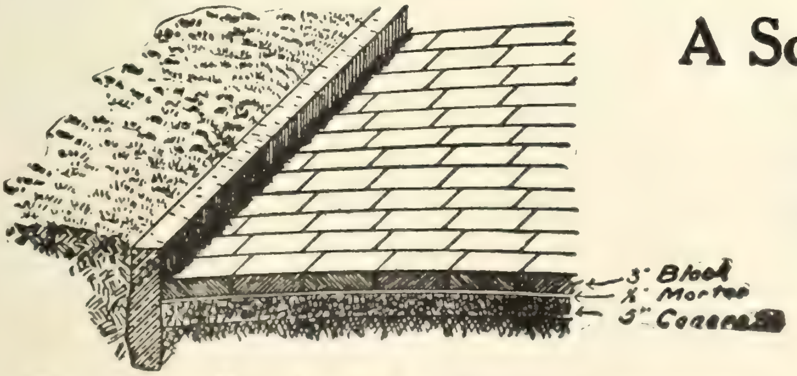

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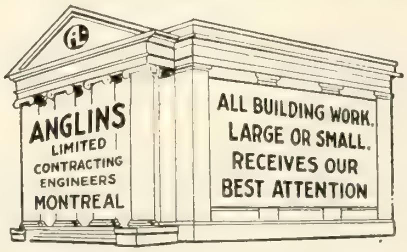

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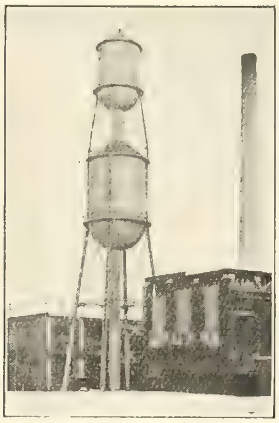

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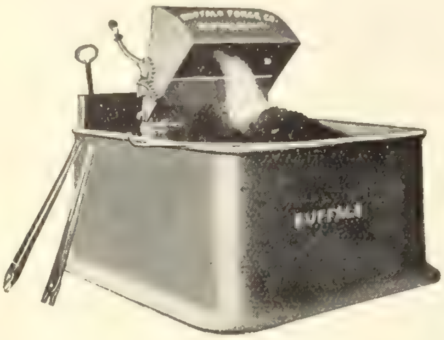

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Do away with such costly systems—costly not only in dollars and cents, but costly too in employees' health. The employer who looks to the welfare of his employees is surely insuring the steady income of his dollars and cents.

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Are built entirely of cast iron. The edges are wide and possess the strength necessary for any service. No work too large for Buffalo Forges. The Down Draft Hood is adjustable by means of a lever gear to any position as may be required by the operator.

All smoke, fumes and gases generated by the fire are carried away, leaving the atmosphere pure and clear. This is *the* commercial shop design.

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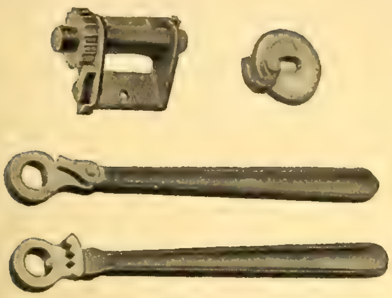
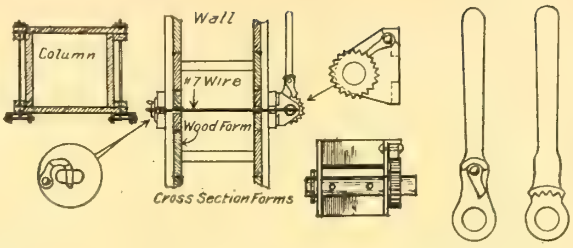


Replace the old twisted wire way of bracing forms for concrete work with



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The one positive means of bracing forms.

Forms clamped with Peerless Wire clamps won't bulge and won't leak at the planking joints when a wet mixture is used.

Simple and Inexpensive

First cost is low; easily operated by unskilled labor; requires least cutting of form work; most easily removed from forms and used over and over again.

Made of two simple, strong cast iron parts, weighing 2½ lbs. and a wrench is furnished, either style, free.

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Sales Agents for City of Winnipeg and Provinces of
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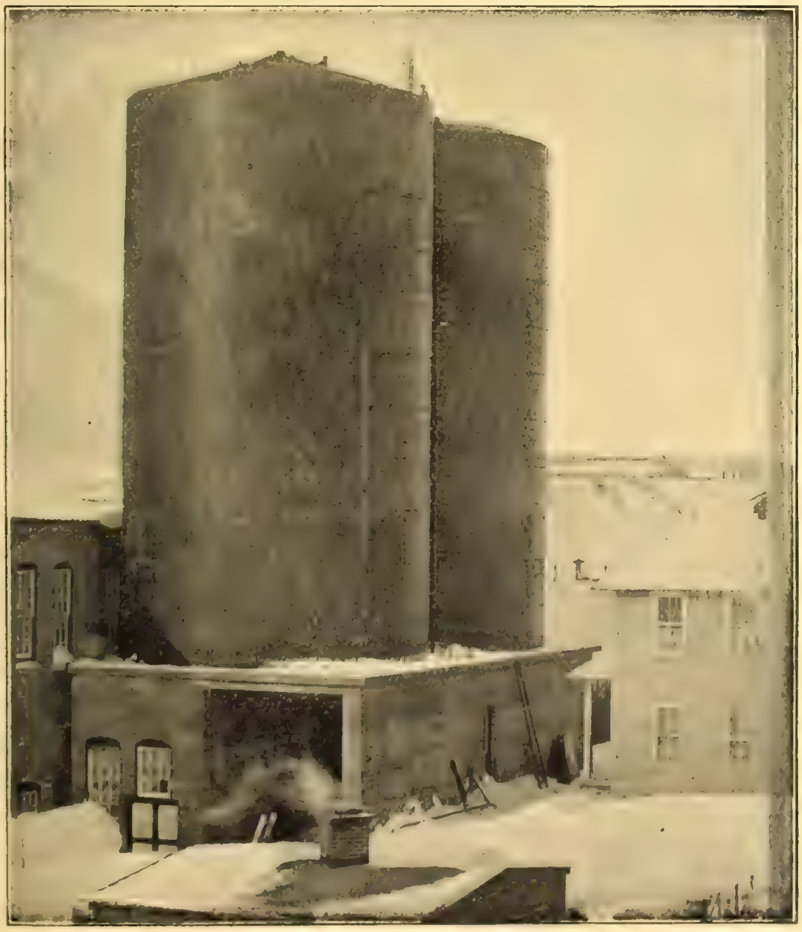

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Manufactured by the World Famous Makers
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If your Contract is for Dredging, Excavating, Building Sewers, or the Re-handling of materials
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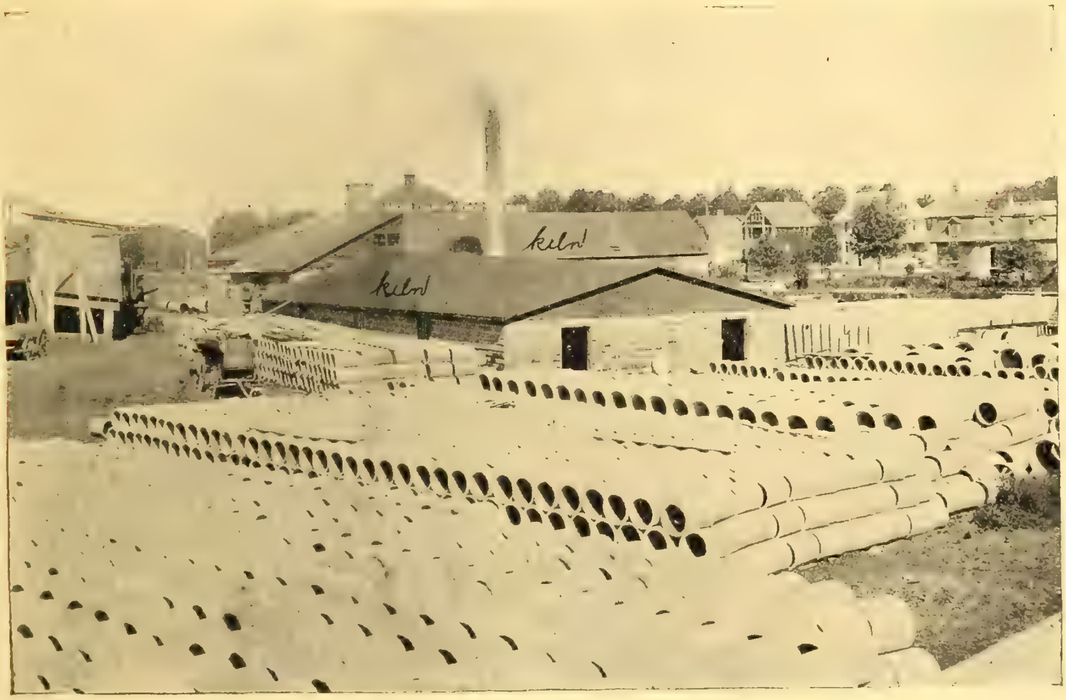
MONTREAL

Vol. 29 Toronto, August 11, 1915 No. 32

Contract Record and Engineering Review

ESTABLISHED 1886

Concrete Pipe



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We also have portable plants for manufacturing the larger sizes of concrete pipe on the job. A new and unusually strong lock joint is a feature of our continuous reinforced concrete pipe that claims your attention.

B. Blair Company, Limited, WOODSTOCK, ONTARIO

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements Page 6

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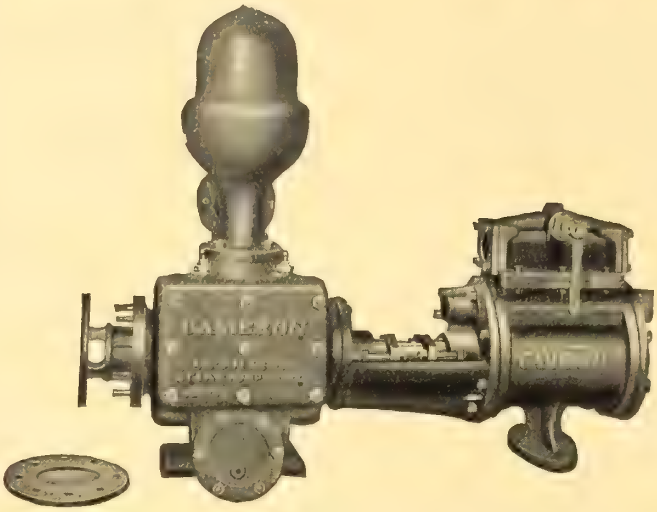

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The use of a removable cylinder liner secures the greatest possible durability in a pump. This bushing may be turned so that the wear, which is usually greatest on the bottom, can be gradually distributed over every portion of its surface. Then when it is completely worn out a new bushing may be put in without moving the pump or disconnecting the piping.

These pumps last a lifetime.

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28 "Service" Branches
Throughout Canada

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"STABILITY"

No matter how extensive your rubber goods requirements may be, we have an unrivalled experience, unequalled resources, and the financial stability to handle your order with maximum efficiency.

And furthermore, what is equally true—no order is too small to warrant our prompt and careful attention.

Our line-up is complete, our quality is unexcelled and our prices are right. Let us show you what we can do.

It is our desire to serve you.

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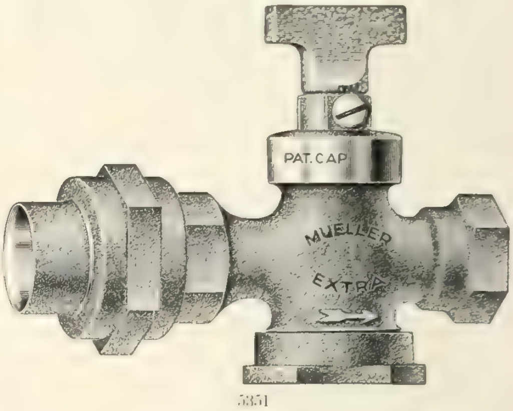
MUELLER

The Mueller trade mark is the name MUELLER. No fancy or curious design—just the plain letters MUELLER, meaning high quality water, plumbing and gas brass goods.

MUELLER

Patent Cap Lead Flange

Curb Cock



This No. 86 Inverted Key pattern of the lead flange type of curb cocks is a splendid representative of Mueller Quality products. It is a staunch, dependable article—good metal, fine workmanship and good service-giving qualities. You can't beat it. Users of Mueller Goods are insured against defects by our 200 pound hydraulic pressure test.

The H. Mueller Mfg. Co., Limited, of Sarnia, Ontario, makes a complete line of water works goods—tapping machines, goosenecks, branch connections, corporation cocks, service boxes, etc. Let us have your orders.

C. R.

**H.
Mueller
Mfg. Co.
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Signed ....

City.................... *Prov*.......................

Made in Sarnia, Canada

H. Mueller Mfg. Co., Limited

Sarnia, Ontario

Makers of High Grade Water, Plumbing and Gas Brass Goods

To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

from

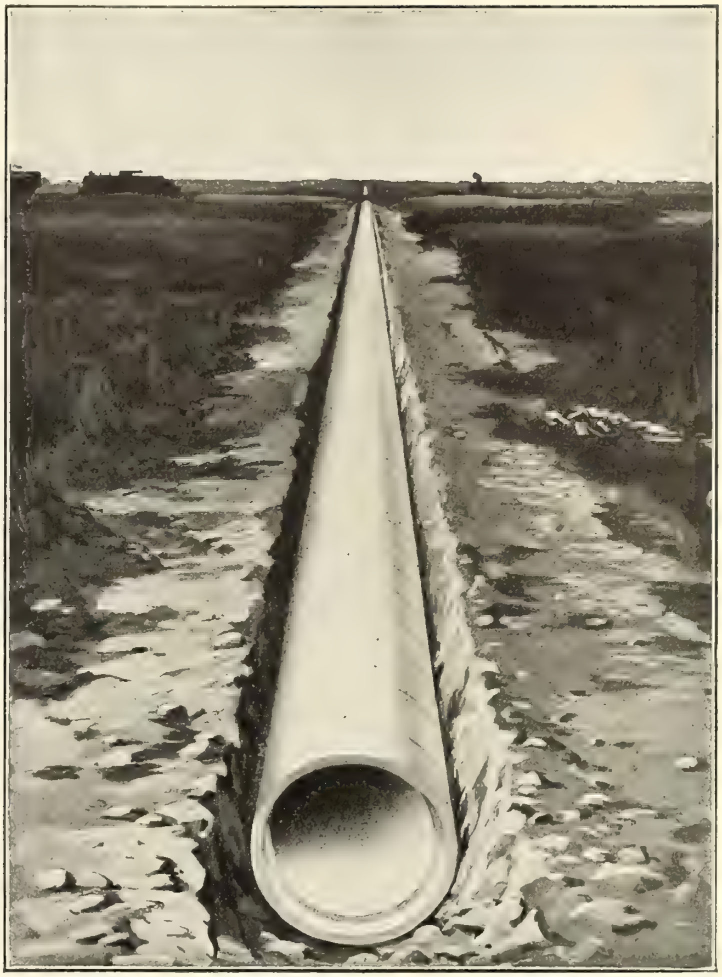
Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.



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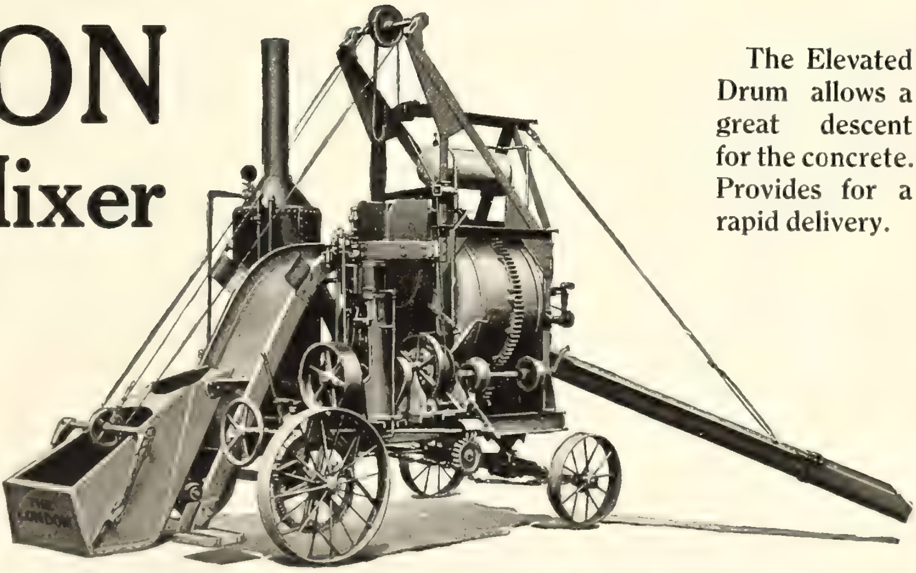
Paving Mixer

Forward Loader and Rear Discharge **take up little room on the roadway.**

Traction Drive. Moves anywhere with its own power.

The Rotary Delivery Chute turns in a complete half circle, also opens up at different points. The concrete is distributed to any part of the road **No wheeling. No shovelling of concrete.**



The Elevated Drum allows a great descent for the concrete. Provides for a rapid delivery.

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Also a full line of Concrete Machinery and Cement Working Tools.

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Can. H. W. Johns-Manville Co.
Conduits Co., Ltd.
Orpen Conduit Co., Ltd.
Ric-wiL Underground Pipe Covering Company

Contractors
Anglins Limited
Wells & Gray

Contractors' Plant & Supplies
Beatty & Sons, M.
Browning Company
Can. Fairbanks-Morse Company
Canadian Equipment Company
Dake Engine Company
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Marsh & Henthorn
Morris Machine Works
Montreal Locomotive Works
Rock & Power Machinery Co.
Stinson-Reeb Builders' Supply Co.

Conveying Machinery
Dull Company, Raymond W.
Goodwin, Barsby & Co.
Sturtevant Co. of Can., Ltd., B. F.

Core Drills
Can. Ingersoll-Rand Co., Ltd.

Corrugated Iron
Can. H. W. Johns-Manville Co.
Metallic Roofing Co.
Pedlar People Limited
Sarnia Metal Products Company

Couplings
Can. Consolidated Rubber Co.

Cranes, Travelling and Locomotive
Browning Company
Hopkins & Co., F. H.
Morris Crane & Hoist Co., Herbert
Northern Crane Works
Pollard Mfg. Company

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Canada Crushed Stone Corporation
Canadian Equipment Company
Crushed Stone, Limited
Hagersville Contracting Co.

Crushers (Stone and Rock)
Dominion Road Machinery Co.
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
London Concrete Machinery Co.
Rock & Power Machinery Co.

Culverts
Pedlar People

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Ceresit Waterproofing Co.

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Aikenhead Hardware Limited
Beatty & Sons, M.
Hopkins & Co., F. H.
Marsh & Henthorn, Limited
Northern Crane Works
Pollard Mfg. Company

Door Hangers
Allith Mfg. Company

Dredging Sleeves
Can. Consolidated Rubber Co.

Dredges
Beatty & Sons, M.
Browning Company
Canadian Equipment Company
Hopkins & Co., F. H.

Drills
Canadian Blower and Forge Co.
Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Lecky & Collis.

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

Dump Carts and Wagons
Canadian Equipment Company
Deere Plow Co., John
Tiffin Wagon Co.
Watson Wagon Co.

Dump Cars, Wheels, etc.
Bechtel, B. E.
Canadian Equipment Company
Hopkins & Co., F. H.
Manitoba Bridge & Iron Works
Marsh & Henthorn
National Steel Car Company
Sheldons Limited

Drying Apparatus
Sturtevant Co. of Can., Ltd., B. F

Electricians' Gloves
Can. Consolidated Rubber Co.

Electricians' Plugs
Can. Consolidated Rubber Co.

Electric Fans
Sturtevant Co. of Can., Ltd., B. F.

Electric Air Rock Drills
Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
Gent & Company

Electric Steel Castings
Electric Steel & Metals Co.

Elevator Doors
Ormsby Company, A. B.

Elevators
Chelsea Elevator Company
Northern Crane Works
Roelofson Elevator Works
Turnbull Elevator Co.

Enamelled Brick
American Enamelled Brick & Tile Company

Excavators
Beatty & Sons, M.
Dull Company, Raymond W.
Hopkins & Co., F. H.
Pawling & Harnischfeger

Exhaust Heads
Canadian Blower and Forge Co.
Sheldons Limited

Engines
Canadian Blower and Forge Co.
Can. Fairbanks-Morse Company
Hopkins & Co., F. H.
Inglis Company, John
Laurie & Lamb
McDougall Caledonian Iron Wks.
Rock & Power Machinery Co.

Engineers (Civil and Mechanical)
Bowman & Connor
Cape Company, E. G. M.
Chipman & Power
Dominion Engineering & Inspection Company
Farmer, John T.
Galt Engineering Co., John
R. S. & W. S. Lea.
McDougall, Geo. K.

Expanded Metal
Pedlar People Limited
Trussed Concrete Steel Co.

Fans
Sheldons Limited
Sturtevant Co. of Can., Ltd., B. F.

Fire Hose
Can. Consolidated Rubber Co.

Filtration Plants
verMehr Engineering Co., John

Fireproof Doors and Windows
Hope & Sons, Henry
Ormsby Company, A. B.
Pedlar People Limited
Steel & Radiation Limited
Trussed Concrete Steel Co.

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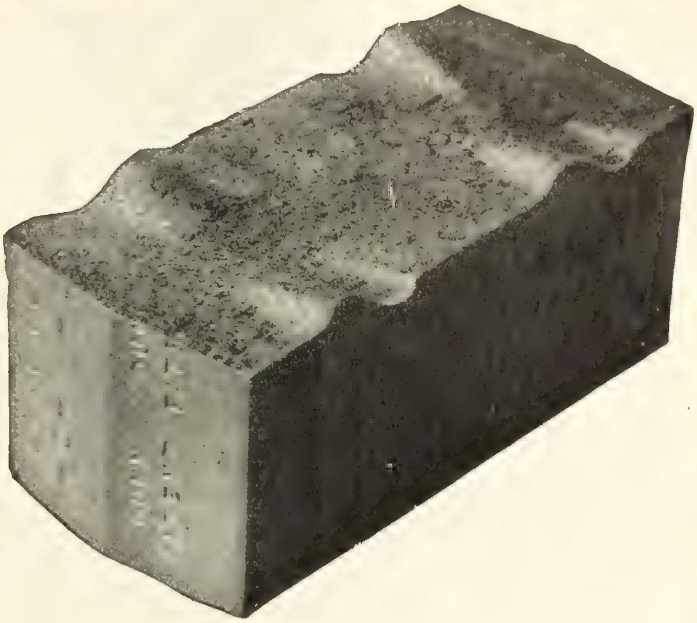

WIRE-CUT-LUG BRICK

USED EXCLUSIVELY FOR BRICK PAVING BY SEVERAL BIG CITIES

Including St. Louis, Mo., Wilmington, Del., Toronto, Canada, Baltimore, Md., and specified by hundreds of large and small cities and by several state highway departments.

Smooth, Even, Sanitary and Durable Pavement

67,000,000 in service in New York State alone.

Lays uniformly and bonds much stronger than any other, as official tests prove.

Advising engineering service free.

Manufactured by the following 26 independent, competing companies operating 42 plants:

Corry Brick & Tile Company, Corry, Pa.
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Sterling Brick Company, Olean, N. Y.
Reynoldsville Brick & Tile Co., Reynoldsville, Pa.
Danville Brick Company, Danville, Ill.
Clinton Paving Brick Company, Clinton, Ind.
Alton Brick Company, Alton, Ill.
Deckman-Duty Brick Company, Cleveland, Ohio.
  Plants at Cleveland, Carrollton and Malvern, O.
Tuna Valley Pressed Brick Company, Bradford, Pa.
Foster Paving Block Company, Bradford, Pa.
  Plants at Bradford, Pa., Binghamton, N.Y., and Youngsville, Pa.
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Bessemer Limestone Company, Youngstown, Ohio.
  Three plants at Bessemer, Pa.
Peebles Paving Brick Company, Portsmouth, Ohio.
  Two plants at Portsmouth, Ohio, one at Firebrick, Ky.
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Southern Clay Mfg. Company, Chattanooga, Tenn.
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McAvoy Vitrified Brick Company, Philadelphia, Pa.
  Plant at Perkiomen Junction, Pa.
Windsor Brick Company, Akron, Ohio.
Hocking Valley Brick Company, Columbus, Ohio.
  Plant at Logan, Ohio.
Veedersburg Paver Company, Veedersburg, Ind.
Springfield Paving Brick Company, Springfield, Ill.
Terre Haute Vitrified Brick Co., Terre Haute, Ind.
Albion Vitrified Brick Co., Albion, Ill.
Alliance Clay Product Company, Alliance, Ohio.
Westport Paving Brick Company, Baltimore, Md.
Mack Manufacturing Company, New Cumberland, W.Va.
  Four plants at New Cumberland, W. Va.
The Hydraulic-Press Brick Company, St. Louis, Mo.

THE DUNN WIRE-CUT-LUG BRICK CO.

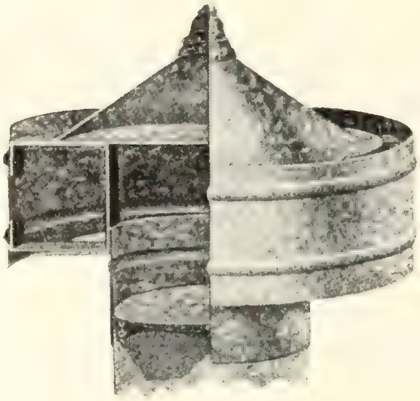
(Licensors)

CONNEAUT, OHIO

SARNIA
M.P.Co

"QUALITY FIRST"

SARNIA
STEEL
VENTILATORS



Specially designed for

SCHOOLS **CHURCHES**
THEATRES **FACTORIES** ETC

The Sarnia Ventilator is made of the best grade galvanized iron of a heavier gauge than is generally used by other manufacturers of ventilators and meets the requirements of durability and highest efficiency, as well as cheapness, and is recognized as one of the finest storm-proof ventilators. Its construction is based on strictly scientific principles and its simplicity is one of its greatest advantages. It is made with the greatest care that skill and experience can accomplish, and is unequalled for strength, rigidity and lasting qualities.

It is especially valuable in removing all foul air, gases, odors, moisture and steam from foundries, etc.

We also manufacture Plain Galvanized Iron, Corrugated Iron, Metal Sidings, House Shingles, Barn Shingles, Sky Lights, Eave Trough, Conductor Pipe, Volleys, etc.

Write for special literature on any of the above products.

SARNIA METAL PRODUCTS CO.
Limited
SARNIA, ONTARIO

KERR
Gate Valves
and
Fire Hydrants
"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

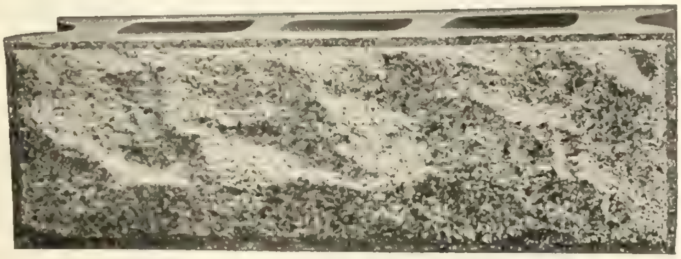
Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO



8 x 8 x 24 inch Granite Rock Face Block

Molds for Casting
Waterproof Hollow Cement Building Blocks
With Granite Faces

THEY COST LESS — THEY SELL FOR MORE
YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.

8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited **(Zagelmeyer System)**
298 Howard Avenue, WINDSOR, ONTARIO

Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure

Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Build Your Sewers Now

And Save Money To Ratepayers

Competition is very keen in all lines right now and ours has not escaped. Contractors need work and are tendering closer to rock-bottom than they have for many years. All material has dwindled in price. So has labor.

You can save 20% to 30% of normal cost by building your sewers now. The extra ½% or 1% that money costs is swallowed up by the saving on work.

—BUY NOW—

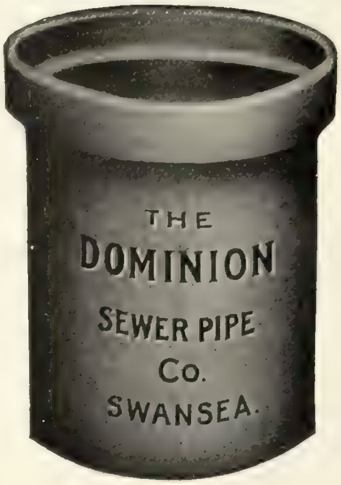
and keep the wheels of progress turning.

The Ontario Sewer Pipe Co., Ltd.
MIMICO, ONT.

SWANSEA

Salt Glazed and Vitrified

SEWER PIPES



True to Size
Impervious to Water.

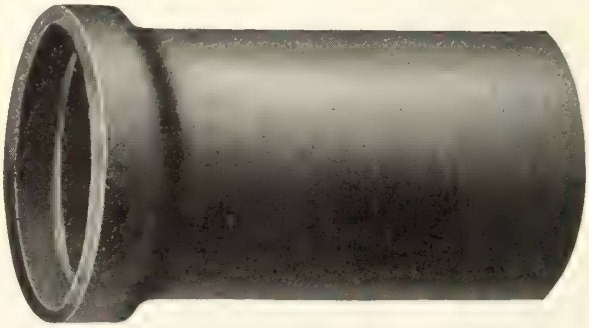
Sizes manufactured and always in tock 4 in. to 24 in.

Ask for Price List and Discounts

also
Chimney Tops
Flue Linings
Wall Coping
Culvert Pipe
Inverts

Telephone (Toronto Connection)
Parkdale 5000

The Dominion Sewer Pipe Co.
(The Independent Co.) Limited
SWANSEA (near Toronto)



Town and City Sewers

In our salt glazed vitrified sewer pipe we offer the highest type of sewer material. Pipe of our manufacture have been used in practically every city in Canada. Highly glazed and perfectly vitrified.

If you are contemplating sewer construction we can quote you some attractive prices. We also make all classes of fire clay goods.

Prompt shipment on all orders.

Made in Canada with Canadian Clay, Canadian Coal, and by Canadian Workmen.

Standard Clay Products Limited

THREE SEWER PIPE FACTORIES : **St. Johns, P. Q., and New Glasgow, N. S.**
ALSO FIRE CLAY FACTORY AT ST. JOHNS, P. Q.

Large Capacity Derricks

We can deliver steel guy derricks up to 50 tons capacity. Our derricks are made in Canada by the power of Niagara. Nothing but the best materials enter into their manufacture. We manufacture derrick irons for wooden derricks in all sizes.

Ask us for literature and prices.

POLLARD MFG. CO.
LIMITED
Niagara Falls, Canada

The Daylight is There

Harness It With LUXFER Prisms

Every new building should be equipped with Luxfer Prisms in order to get daylight into the interior

Once installed "Luxfer" costs nothing to maintain. Luxfer sidewalk prisms are set in wrought iron frames which cannot warp or sag.

Luxfer is the one prism that will give definite results—no guess work.

Always specify the safe system—Luxfer.

LUXFER PRISM COMPANY, LIMITED
100 King Street West, Toronto, Ont.

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Fire Escapes
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McGregor & McIntyre

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Force Cups
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Fuel Economizers
Sturtevant Co. of Can., Ltd., B. F.

Furnaces
Toronto Furnace & Crematory Company

Forges
Canadian Blower and Forge Co.
Sheldons Limited

Form Clamps
Peerless Form Clamp Co.

Furnaces
Smart Mfg. Co., Jas.

Gaskets
Can. Consolidated Rubber Co.

Gas Engines
Goold, Shapley & Muir Co.

Gasoline Engines
Canadian Fairbanks-Morse Co.
Goold, Shapley & Muir Co.
London Concrete Machinery Co.

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De Laval Steam Turbine Co.

Glass
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Excelsior Plate Glass Co.
Luxfer Prism Company
Pilkington Bros.
Toronto Plate Glass Imp't'g Co.

Gravel Washing Plants
Dull Company, Raymond W.

Hammer Drills
Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
Pittsburgh Valve, Foundry & Construction Company

Heating Apparatus
Canadian Blower and Forge Co.
Sheldons Limited
Smart Mfg. Co., Jas.
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Hose, Garden and Lawn
Can. Consolidated Rubber Co.

Hoists, Electric
Northern Crane Works

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Canadian Ingersoll-Rand Co.
Gillis & Geoghegan
Goold, Shapley & Muir Co.
London Concrete Machinery Co.
Marsh & Henthorn
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Gartshore-Thompson Pipe Co.
Kerr Engine Company

Incinerators
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Toronto Furnace & Crematory Co.

Insulating Compounds
Can. H. W. Johns-Manville Co., Limited.
Standard Underground Cable Co. of Canada, Limited

Industrial Cars
Hopkins & Co., F. H.
Bechtel, B. E.

Interior Finish and Doors
Canadian Office & School Fur. Co.

Jib Cranes (all kinds)
Morris Crane & Hoist Co., Herbert
Northern Crane Works

Kilns
Canadian Blower and Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.

Kyanized Spruce
Berlin Mills Company

Lath Board
Bishopric Wall Board Co.

Lead Pencils
American Lead Pencil Company

Lime
Dominion Lime Company
Standard White Lime Co.

Lighting and Pumping Installations
Can. H. W. Johns-Manville Co., Limited

Locomotives
Canadian Equipment Company
Montreal Locomotive Works

Marble Working Machinery
Pollard Mfg. Company

Metal Lath
Metallic Roofing Company
Noble, C. W.
Pedlar People Limited
Steel & Radiation Ltd.
Trussed Concrete Steel Co.

Metallic Roofing
Pedlar People Limited

Mechanical Draft Apparatus
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Meter Boxes
Ford Meter Box Company

Meters, Water
McDougall Caledonian Iron Wks.
Neptune Meter Co.

Moulds for Cement Blocks
Cast Stone Block & Machine Co.

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Wayne Oil Tank & Pump Co.

Oil Tanks
Wayne Oil, Tank & Pump Co.

Ornamental Moulds
London Concrete Machinery Co.

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Morris Crane & Hoist Co., Herbert

Packing
Can. Consolidated Rubber Co.

Paints and Varnishes
Dominion Paint Works
Hopkins & Co., F. H.

Paving and Paving Materials
Asphalt & Supply Company
Barber Asphalt Paving Co.
Dunn Wire-Cut-Lug Brick Co.
National Paving Brick Manufacturers' Association
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.

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Dominion Concrete Co.
Gartshore-Thomson Pipe Co.
National Iron Works
Pacific Coast Pipe Co.
United States Cast Iron Pipe Co.
Vancouver Wood Pipe & Tank Company
Warren Foundry & Machine Co.

(Continued on Page 14)

Easily Operated by One Man

THE G & G Telescopic Hoist Model A illustrated, makes it possible for one man unaided to perform the entire operation of raising ash cans to sidewalk and lowering empty cans to cellar.

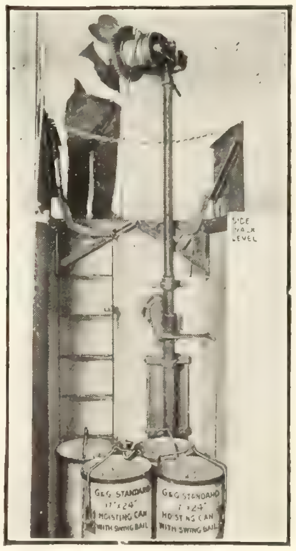
SIDE WALK LEVEL
G&G STANDARD 17"x24" HOISTING CAN WITH SWING BAIL
G&G STANDARD 17"x24" HOISTING CAN WITH SWING BAIL

Illustration also shows the G & G Sidewalk Door Opening and Closing Device which automatically opens and closes doors as hoisting head is raised or telescoped.

The G&G PATENTED Telescopic Hoist
with compound gear and brake attachment

Made
in
Canada

Raises a maximum load of 500 lbs. at a guaranteed speed of 30 feet per minute.

When not in use hoist telescopes and no part shows above street level.

It is fitted with a patented "silencer" that makes it practically noiseless in operation.

Operates from sidewalk level—protecting public from danger of unguarded open hatch and protecting operator from injury should anything fall into hatch.

Every hoist is subjected to thorough working test before shipment.

Write to our nearest agent for new booklet and prices

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Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

W. T. Grose, Agent for Manitoba, Saskatchewan, Alberta, Winnipeg

TRADE **CHAMPION** MARK

A Complete Line of Road, Street and Contractors' Machinery

Champion Distributor

Champion Oil Distributors

A complete line of Oil Distributors for the applying of light Oils as dust preventatives, or the heavy Asphaltic or Tar Binders Especially designed; durable and adapted for blanket treatment or penetration method of distribution. Let us solve that road oiling problem for you!

THE DOMINION ROAD MACHINERY CO., LIMITED, Goderich, Ont.

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

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American Lead Pencil Company

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Hopkins & Co., F. H.
Marsh & Henthorn, Limited

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Canadian Ingersoll-Rand Co.
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De Laval Steam Turbine Co.
Hamilton Mfg. Co., Wm.
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Laurie Company, E.
McDougall Caledonian Iron Wks.
Morris Machine Works
Smart-Turner Machine Co.
Turbine Equipment Company

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George Anderson & Co.
Goodwin, Barsby & Company

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Goodwin, Barsby & Company

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Scales
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Britnell & Company
Canada Iron Corporation
Dominion Sewer Pipe Co.
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London Concrete Machinery Co.
National Iron Works
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Standard Clay Products Ltd.

Sheathing Board
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Montreal Locomotive Works

Silo Moulds
London Concrete Machinery Co.

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Pedlar People Limited

Smoke Stacks
Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
Hamilton Mfg. Co., Wm.
MacKinnon, Holmes & Co.
Manitoba Bridge & Iron Works
Pittsburgh-DesMoines Steel Co.
Pedlar People Limited

ARTIFICIAL MARBLE

Made in Canada

ARTIFICIAL MARBLE is a material manufactured by a new process. The ARTIFICIAL MARBLE is harder than natural marble, is less absorbent and is susceptible to a higher finish. The coloring is non-fading and runs entirely through the marble.

ARTIFICIAL MARBLE is polished (not varnished) in the same manner and with the same material as natural marble.

ARCHITECTS:—Patronize a home industry and specify ARTIFICIAL MARBLE made by a Canadian firm, and with Canadian material.

We manufacture ARTIFICIAL MARBLE in all the beautiful colorings of the Italian, Greek, French and Belgian marbles, and the well known Canadian and American marbles, and our facilities are adequate to turn out the largest contracts.

Specify ARTIFICIAL MARBLE and avoid delays caused by the unsoundness of natural marble quarries.

Manufactured by

J. E. CARREAU

Office and Factory, 13 Notre Dame St., East
Phone Main 427-428—Connecting All Departments
MONTREAL

CRUSHED STONE

Good Roads Making Good
by using

Dundas Stone

Best by Test

Canada Crushed Stone Corporation, Limited

DUNDAS, ONTARIO

Toronto Agents:—Rogers Supply Co., Limited, 38 King Street West

---

DUNDAS QUARRY
Capacity 4000 Tons Daily

OUR
Facilities for supplying any quantity of
CLEAN CRUSHED STONE
Are Unexcelled

SHIPMENTS — G. T. R. & C. P. R.
Team Delivery If Required

CEMENT
SAND

GRANOLITHIC
TRAP-ROCK

Rogers Supply Co., Limited

28 King St. W., Toronto

MAIN 4155

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Stair Builders
McGregor & McIntyre

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Electric Steel & Metals Co.

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Morrison & Co., T. A.
Oakley & Son, Geo.
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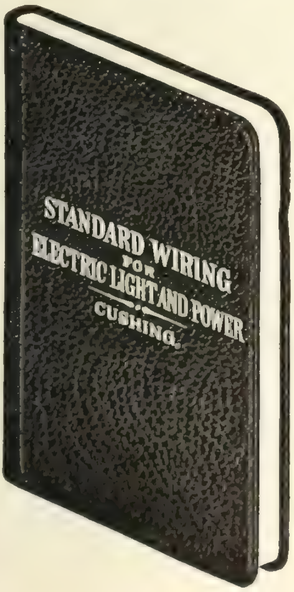

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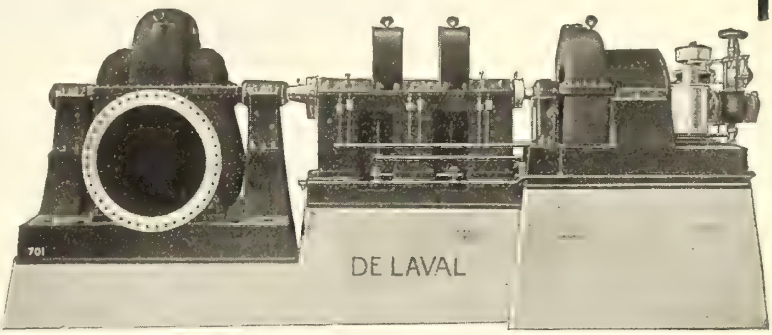

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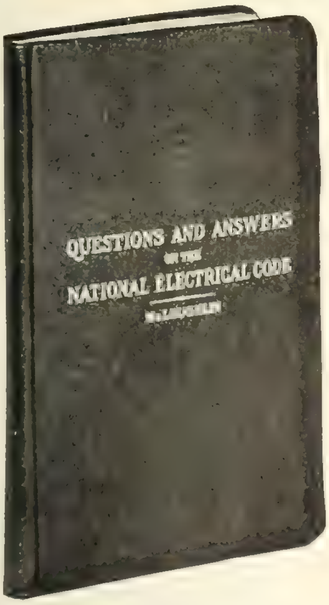

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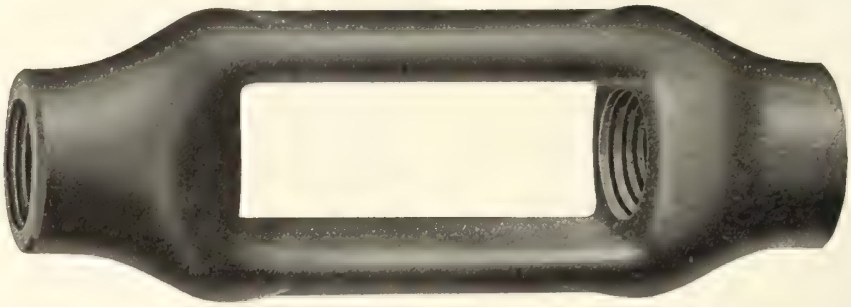

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What Effect Will the Conflict in the Old World Have Upon the Development of the New?

When the present unhappy conflict in Europe first started, people began to ask each other, How long will the war last? This question has been bandied from one to the other until it has become tiresome. Perhaps there has been some excuse for speculation of the kind, seeing that European wars on such a scale have not been an everyday occurrence in the lives of most of the speculators.

It is significant that people no longer make it a matter of vital concern whether the war will last another six months or another six years. They are beginning to appreciate the hard fact that business cannot be conducted "as usual," and that the stability of their incomes can be maintained only by enterprise and effort. The war, with the conditions attendant upon it, is beginning to sink in deeper, and the elementary questions propounded a year ago are giving place to serious ideas worthy of consideration and discussion. Such an idea is embodied in the caption of this article. The question, which is asked by a reader of The Contract Record, provides food for reflection.

The phenomenal development which this country has witnessed during the last decade has been attributable almost entirely to the ever-increasing stream of immigrants from the Old Country. Almost any western town or city bears out this assertion—Vancouver, the Gateway to the Pacific; Calgary, the cow-town of a decade since; Winnipeg, a generation or so ago little more than a trading post; Edmonton, Saskatoon, and many others. Whether we like it or not, we must consider the hard, cold fact that the stream of immigration is cut off—for the present, at any rate—and that we are now face to face with the situation of holding our own.

It is a gratifying reflection that so far, thanks largely to the enterprise of the manufacturing interests and the extent to which they have been able to cope with emergency war orders on an unparalleled scale, we have been able to hold our own. We find business actually picking up in the manufacturing centres, owing to the receipt of these large war orders from Britain and her allies. Railway earnings are improving, and the money market is featured by a gradual strengthening of rates as the crop-moving period approaches. Canadian steel mills are getting a good deal of business from the Old Country, for steel and iron products, and it is believed that Canada is finding a permanent place in the British market.

There is no doubt whatever that the situation in Canada thus far has been saved by the country's supreme confidence, not only in the Empire, but in itself. Confidence, then, business enterprise, and manufacturing supremacy, are the three pillars upon which the country's prosperity must be stayed during the period of the war. And what then? Some would say the Deluge, but we think not.

There are those who, in discussing the prospects of the country upon the termination of hostilities, will point to the millions that have fallen, and to the unprecedented destruction in the ravaged cities of France and Belgium. They will tell you that every mechanic will find a place—and a good place—in Europe, and that the Old World will supersede the New in constructional attraction.

With this we are not in accord. We may be sure that for long enough after the declaration of peace, finances will not be forthcoming so readily for the rebuilding of half a continent, and that much of the restoration will come about rather as a sort of evolution than as a sudden enterprise. Moreover, in the matter of such principles we may learn much from history. It is a fact that the greatest periods of colonial expansion followed immediately upon the great wars of the eighteenth and nineteenth centuries. There are those of us who can recall the impetus given to immigration by the Franco-Prussion war, and later by the South African war.

For our own part, we look upon the present troublous time as affording Canada an opportunity of self-examination and preparation. It is a time when all matters appertaining to public and private administration should be overhauled, when loopholes should be detected, and false economies exposed, when the affairs of the State should be placed upon a sure foundation, and the affairs of the individual strengthened and purified.

Canada has a great future, and the prospects of the country are enhanced rather than diminished by the losses sustained in the Old World.

Montreal's Far-Famed Water-Works System

READERS of the Contract Record are aware that the city of Montreal is carrying out an extensive scheme for improving the waterworks, enlarging the aqueduct, and constructing a hydro-electric plant. It is proposed to revise the original plans and, with the approval of Messrs. Hering and Fuller, lonsulting engineers, of New York, to spend a further large sum on the scheme. This decision has resulted in some particularly trenchant criticism by Mr. J. A. Jamieson, who with Mr. R. S. Lea and Mr. G. R. Heckle reported on the water conduit when there was a serious break in the pipe, in December, 1913, causing great inconvenience to the city.

Mr Jamieson argues strongly in favor of no further expenditure being made until the project has been studied and reported on by thoroughly qualified engineers, and in this he is supported by a resolution of the Canadian Society of Civil Engineers. Controller Cote, who is responsible for the engineering department of the city, has replied in no less vigorous tones to Mr. Jamieson, and intimates that it is intended to carry out the scheme notwithstanding the "unjust criticism" which has been made.

In his "open letter," Mr. Jamieson declares that the information gathered by himself and his colleagues indicates that the aqueduct power development was not an economic proposition, and that the excessive cost would impose a heavy burden on the city from which an adequate return in power development could not possibly be obtained. "It was these facts which convinced us, after mature deliberation, that it was our duty to make the recommendation that a commission of engineers should be immediately appointed to investigate the whole aqueduct power project with the conviction that a modification of the whole scheme might be made which would save the city a large sum and also heavy expense in litigation with the contractors." The proposed retaining walls are, he says, entirely unnecessary, either for the aqueduct or the support of the conduit, as the banks can be sloped in accordance with the usual practice in canal or head race construction, thus saving about $2,000,000. Mr. Jamieson estimates the total cost to be $7,500,000 for a development, estimated by Mr. Janin, the chief civic engineer, to be capable of producing 10,000 horse power. He believes, however, that owing to climatic conditions, only 7,500 horse power can be developed, and on this basis the cost will equal $1,000 per horse power, or over eight times the average cost of hydro-electric development in the vicinity of Montreal, including the transmission line to deliver the current in the city limits. "This is an unprecedented cost for a power development in any part of the world, and particularly for a hydraulic development which will require an auxiliary steam plant, or hydro-electric standby equal to nearly 100 per cent. of its normal capacity."

In reference to representations made to the committee of aldermen on their recent visit to the aqueduct, "that the retaining walls were urgently required to prevent another failure in the conduit," Mr. Jamieson has a very full knowledge of the condition of the conduit and the banks of the aqueduct in which it is embedded, and cannot find any justification for this claim. While the conduit is not of the best design, and was not nearly as heavily reinforced with steel as it should have been when constructed for the purpose intended, it is now, after the repairs made to it during 1914, quite safe if left undisturbed by further overload or excavation too close to it.

Mr. Cote points out in reply that the scheme has already been reported on by many eminent engineers, and insists that it is a good and economical plan, and that no further examination is necessary. The scheme will provide the necessary power for pumping and also for lighting the city streets. The additional cost is unavoidable, owing to higher prices and other causes. The annual outlay of pumping and lighting is estimated at $495,000, representing at 5 per cent. a capitalization of $9,900,000, a "sum very much in excess of the $7,000,000 which the development would cost and leaving a very substantial margin for installation and transmission charges, and naturally the municipality is in possession of its own privileges at the lesser cost." Mr. Cote declares that 10,000 horse power will be developed, and that there is no danger from frazil ice such as is feared by Mr. Jamieson.

The reason for the criticism was the extra appropriation to "strengthen the original design of the concrete retaining walls forming the sides of the aqueduct, and this despite the fact that in your letter you criticize the construction of the lateral conduit as being too weak. You evidently would like to see the walls built in the lightest manner, and not strengthened, as they are to be, to meet the most exacting criticism of engineering science." With regard to the criticism that sloped embankments should have been substituted for the semi-vertical concrete walls adopted for the lining of the aqueduct sides, the experience with the sloping banks of the old aqueduct in the fifty years of its existence showed they were a source of considerable trouble and expense through the displacing of the rip-rap facing at the water line from ice each winter, and some more modern method of protecting the water line, such as concrete facing, if introduced would have entailed much added cost. Then, again, banks at a minimum slope of 2 to 1 would have necessitated an extra width of land of about 54 feet, to be expropriated, which at an average price of 50 cents per foot would have entailed an extra cost of $27 per lineal foot of aqueduct, or $459,000 on the 17,000 feet comprising the lower or first earth section alone. Furthermore, the velocity of flow of the aqueduct would have greatly diminished with sloped banks, as compared to the concrete side walls. The modifications made in the specifications for definite design of the test wall were to meet local conditions and the design as now decided upon is the result of this study.

Mr. Jamieson, concludes Mr. Cote, tried in 1914 to persistently convince him that the conduit was unsafe, that the design and construction were defective, and that it was absolutely necessary to build a new one, but he was glad to find out from Mr. Jamieson's letter that the conduit is quite safe if left undisturbed.

Co-Operation of Railways and Municipalities a Pleasing Development

As reported elsewhere in this issue, the Dominion Railway Commission has made a low commodity rate for gravel consigned to municipalities for road-making and highway improvements. The formal order only applies to Western Ontario and is 50 cents a ton for any distance including and up to fifty miles for carload lots. The order, however, will be extended so as to apply to all parts of the province.

The order was practically made by consent. The railway companies had first resented the application for the commodity rate upon the ground that they were applying for a general increase in freight rates east of Lake Superior. However, they yielded to the representations of Sir H. L. Drayton, Chief Commissioner, who appealed to them upon grounds of public policy.

The order is without prejudice to the application of the railways for higher freight rates. The companies, however, are to be commended upon the fair spirit they have evinced in this matter, and the Chief Commissioner has given them full credit in the memorandum made public.

Cases of excessive corrosion of iron and steel bridges are detailed and illustrated in a paper by Frederic H. Fay presented recently before the Engineers' Society of Western Pennsylvania. Badly corroded truss eyebars of steel are pictured, in which a loss of nearly 70 per cent. of the section occurred in the worst case. Casual examination of such structures fails to give a true idea of their condition, as the rust scales were so thick that loss of section could not be detected. Protection by the use of reinforced concrete securely attached to the steel is recommended, also the use of excessive metal section or even extra cover plates in locations particularly exposed to corrosion. The bottom flanges of overhead beams should be treated by the latter method, in the opinion of Mr. Fay. The most noticeable causes of corrosion are given as exposure to locomotive gases, exposure to sea water or surface water leaking through the bridge floor, and over-stress of metal which hastens corrosive action. Brine drippings from refrigeration cars on railroad bridges and coal-tar mixture dropped from wood-block pavement, which removes paint, were also mentioned as agents of corrosion.

Planning on Contract Work

It must be admitted that there are many deficient contracting organizations where adequate attention is given to planning. Such, for example, are some of the very large organizations with ample backing, manned not by men placed there by financiers as actual managers of a business venture, but by hard-headed, shrewd contractors who have risen with or without college education, through the school of hard knocks. Such, also, are some of the very small organizations, where the owner takes but one job at a time and lives on it. In these small organizations, however, there is less likelihood of the separation of the planning and doing functions, though the planning is properly provided for.

Taken in the mass, however, contracting organizations are weak on the planning side. On small jobs the weakness is called ignorance of the contracting "game"; on the big ones, lack of efficient management. Analyzed, however, it will be found that the deficiency is the fundamental one of lack of thinking —of being too busy doing the work to spend any time in anticipating problems and providing in advance for their solution.

Recently two striking instances of brain versus brawn have come to the attention of this journal. Contractors of two types are working side by side on jobs presenting similar difficulties under identical conditions. In the one case the structure being built is of a very complicated nature. The one contract is going ahead in a rapid, orderly way, the men moving about with an assurance which indicates that they know what they are doing and how to do it. In every department of the work the orderliness and vigor of the activity is evident. On the adjoining contract paralysis in certain phases of the work is evident. Here, equipment is lacking; there, materials (though the job has been in progress six months). In another place men have been withdrawn for no apparent reason. The one job looks ship-shape, successful; the other, disorderly, almost hopeless. Even the layman ignorant of construction methods would declare the one job efficient, the other inefficient. The very atmosphere of the two tells the story. The successful organization is manned by old-time contractors, with a reputation for carrying through difficult jobs successfully. The other is a business venture by financiers knowing nothing of contracting but placing their faith in energetic men whose management is of the brawn rather than of the brain type.

In the other case the adjoining contracts are on railroad grading. In fact, there are half a dozen contractors doing similar work, yet one of them, month after month, gets out one-third more yardage with his steam shovels than any of his competitors. The contractor is noted among his acquaintances as a clear thinker who never tires of developing new methods of attack, who is as "long" on thinking as he is on vigor of execution.

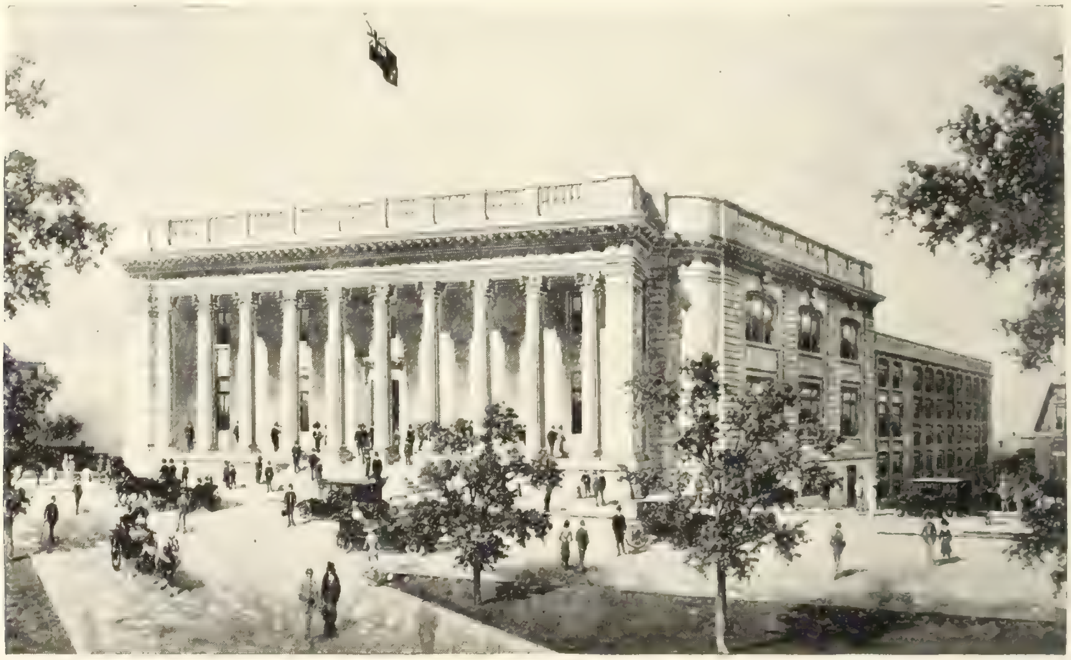
Every contractor and engineer can multiply instances of this sort. There will be those who claim that contract work, on the whole, is conducted quite as efficiently as other lines of business. This journal, however, has indicated its disagreement with these critics and knows that an impartial inquiry will show that its position is correct. As it has pointed out, contracting, fundamentally is more difficult to handle efficiently than a factory. In the latter there is endless repetition of operations capable of being divided into small parts. For this reason it is economical to pend a great deal of time in studying the machines and the methods for each of these operations, for the slight saving on each unit makes a tremendous volume in the aggregate. Furthermore, in factory work operations may readily be supervised closely. On contract work the very opposite conditions obtain. There is comparatively little repetition, and such as there is, is divided into relatively large elements, such as the placing of a whole floor of reinforcement, the erection of thousands of square feet of forms, etc. Again each single manual operation entering into contract work is not often enough repeated to enable it to be standardized with the thoroughness of factory work, while, evidently, supervision is much more difficult. There enters, too, the element of fatigue, far more serious on contract work, because of the rather strenuous character of the manual operations and less serious in factory operation. All of these points tend to make it more difficult to secure as high an efficiency in contract work as in factory operation, and this fact, sensed unconsciously by contractors, has deterred them from the refinement whose merit the factory manager never questions.

A corollary to these observations is that the opportunity for improvement in the efficiency of contract work is still very large. Higher efficiency is to be obtained by increasing the percentage of thinking—of planning—and decreasing the percentage of jobs on which the doing is considered to render thinking impossible.—Engineering Record.

Proposed New Civic Library, Montreal

ONE of the most important buildings of the season in Montreal is the civic library, now in course of erection on Sherbrooke, Montcalm and Beaudry Streets, from plans by Mr. Eugene Payette. The contract was the subject of considerable discussion by the City Council, which awarded it to John Quinlan and Company, Montreal, on the understanding that there was to be no sub-contracting.

The work of putting in the foundations was made a separate contract. There are various sections of the city where the ground forms a somewhat uncertain foundation, owing to its being of a clay nature and quite plastic.



New Civic Library, Montreal, now in course of erection. Architect, Mr. Eugene Payette, Montreal; contractors, Messrs. John Quinlan & Company, Montreal.

In building operations in these sections it is necessary to make a careful study of the ground underlying the building contemplated, and to design the foundations with due regard to the best engineering practice.

The Municipal Library is located in a section of the city where the construction of foundations is complicated by the character of the ground overlying the rock to a depth of 40 to 50 feet. This ground is clay in its nature, and as its movements cannot always be controlled, it appeared advisable in the case of the Library Building, to eliminate hazards by founding the building on rock and passing through the treacherous clay soil.

When Mr. Payette reached this decision, steps were promptly taken to proceed with building the foundations. The Foundation Company, Limited, of Montreal, completed the work under the direct supervision of the architect. Owing to the fact that the foundations were all underground, the magnitude of the work was not apparent, even to an interested spectator, as the site was very little changed after the completion of the foundation, the greater bulk being concealed entirely underground.

In all, sixty-six wells were sunk from surface to rock, and filled with concrete. These wells, if placed end to end, would resemble a round concrete chimney 25,041 feet in height. Each one of these is built on ledge rock, all loose rock having been removed; consequently, when the library is completed there will be no danger of any unsightly cracks ruining the expensive and artistic interior, and there will be no treacherous ground lying between the foundation of the building and rock.

The building is of irregular shape, the main portion being on a site 115 ft. x 115 ft., with the principal entrance on Sherbrooke Street; the extension faces on Montcalm Street, the area being 45 feet by 109 feet. The height of the main section is 62.5 feet. The plans show an admirably planned structure, with plenty of light on all four sides. A large amount of marble is to be used in the construction, and wherever possible Canadian material will be employed. There are to be a basement and three storeys. The base of the building is to be of Stanstead granite and the superstructure of Queenston stone. The floors of the principal building will be of terra-cotta and concrete construction, the latter being the chief material selected. The stairways are of Missisquoi marble, which is also used extensively throughout the library; the roof is to be flat, and tiled.

The main distinguishing hall is approached by a short flight of steps on Sherbrooke Street, and through an artistic entrance, the facade being embellished by ten monolithic columns of polished granite. The basement will contain the boiler room, coal bins, ventilation plant (Acme system), storage, and janitor's apartments, which will be at the rear part of the building. On the ground floor, reached from Montcalm and Beaudry Streets, will be located a reading room for children, 39 ft. x 69 ft.; a bindery, 34 ft. x 38 ft.; stationery room, 36 ft. x 31 ft.; receiving rooms for books; a stock room, 40 ft. x 107 ft., which will be lined with Kittanning brick; and toilet rooms.

The main floor is the principal room, and is so arranged as to give free access from every department. The distributing room is 29 ft. x 64 ft.; the reading room 33 ft. x 110 ft.; and the newspaper room 39 ft. x 52 ft. The reading room is on the left of the entrance, while the newspaper, librarians', cataloguing, and stenographers' rooms are on the right. This section also contains telephone booths, coat rooms, etc. The reading room floor is to be lined with cork tile.

From either side of the vestibule wide galleries lead to a gallery constructed of marble on the next floor, from which is reached the art room, 31 ft. x 74 ft.; Canadian room, 31 ft. x 69 ft.; exhibition room, 31 ft. x 37 ft. It is intended to place collections of interest to Canadians in the Canadian room. The gallery is surmounted by a glass roof. The entire furniture will be of oak. The heating is to be by a hot valve system.

The contract price for the building is $461,000 and for the foundations $65,000.

Application of Stucco to Brick Work

In applying stucco to old brick walls, the most important point is that the old surface must be thoroughly cleaned. If coated with paint, this must be scraped or burned off, and if uncoated the surface must be washed with a solution of muriatic acid mixed in the proportion of one part commercial muriatic acid to five parts of water. The wall should be scrubbed with this solution, then thoroughly cleansed with clean water.

The joints between the brick work should be picked back from the face of the bricks to a depth of ½ in. to ¾ in., so as to form a key for the plaster. Immediately before applying the plaster the surface of the walls should be thoroughly soaked with water, for on account of the porous nature of the brick, water would be absorbed from the plaster, thus injuring its strength, unless the brick were thoroughly saturated beforehand.

Sometimes, instead of applying the cement plaster directly to the brick, metal lath is fastened to the brick and the stucco placed on it. Metal furring strips are attached to plugs driven into the joints of the brick work, and the lath is fastened to these strips. This method of construction is always advisable for covering brick chimneys, so as to prevent cracking due to extreme temperature changes.

In applying stucco to new brick work, the procedure is practically the same as described, except in the matter of cleaning off the surface, though the walls should be brushed to remove any mortar that may have splashed on the surface of the brick, at the time of laying up the wall.

Maintenance of Concrete Pavements

THE following recommendations as to proper methods of maintenance of concrete roads, given by Cement World, are based on a survey of the results of up-to-date practice in various parts of the country:—

(1) The imperfection to be repaired should be thoroughly cleaned by brushing until all loose particles have been removed.

(2) If the imperfection extends through the pavement and exceeds 6 in. in breadth or diameter, the sides should, after cleaning, be painted with cement grout, and the cavity filled with concrete of the same mixture and consistency as was used in building the original pavement. If a replacement, the excavation should be back-filled with gravel, well tamped, and the concrete properly reinforced. The repaired portion should be cured by being kept moist for at least four days, and protected from traffic until thoroughly hardened.

(3) When a hole does not extend through the pavement, but exceeds ½ in. in depth, it should be carefully cleaned and dried, and then painted with hot tar. The hole is then filled with stone. Several sizes should be carried by the repair gang, the object being to use in any given hole a size of stone large enough to reach nearly from the bottom of the hole to the surface, but never to use stone exceeding 2½ in. in diameter. Where large sizes of stone are used, voids should be carefully filled with smaller sized stone and the whole tamped or rolled into place. Hot tar is then poured over the patch, gauging the quantity so that the tar will be absorbed without any large excess.

(4) Holes less than ½ in. deep, cracks less than 1 in. wide, and expansion joints from which the filler has wholly or partly disappeared, should be cleaned, dried, and filled a little above level with hot tar, on the surface of which gravel or granite, from ⅛ in. to ¼ in. in size, should be spread from a shovel.

(5) Refined coal tar should be used, having a specific gravity not less than 1.18 nor more than 1.25 at 77 deg. Fah. The tar should be heated to from 225 deg. Fah. to 250 deg. Fah. at the time of application, and may be applied by means of conical-shaped buckets with openings at apex, or by using a sprinkling can. Sand or screenings graded from ⅛ in. to ¼ in. should be spread over the surface, before the tar has cooled enough to prevent the sand from becoming firmly embedded therein to form a permanent wearing surface.

7,000-Foot Pipe Line Floated to Place in Lake Ontario in Long Sections

Lowered and Placed from Pile Bucks and Connected with Special Submarine Joints by a Diver—Terminus of Line in Large Timber Crib

A sixty-six-inch steel pipe line was recently laid in the bed of Lake Ontario for the discharge from the Rochester sewage-disposal plant by floating it into place in long sections, filling the sections with water, lowering them from pile bucks and connecting them with a special submarine joint. The work is described in The Engineering Record by H. A. Brown, Special Assistant Engineer, Rochester, N.Y.

The discharge line extends from the end of the plant to the shore of Lake Ontario, a distance of 1900 ft., in open trench. From this point the pipe is submerged and laid in a dredged trench, terminating in a timber crib 7000 ft. from shore.

Ready to open valves to fill section with water and sink it.

The straight sections of the pipe are of the lock-bar type, 66 in. in diamater, made of ½-in. steel plate in 30-ft. tapered sections. The pipe for the land section was unloaded on the site of the work. That for the lake section was delivered at a yard on the river, 2 miles away. A shallow beach and a main-line railroad track made the launching of long sections of pipe at the work practically impossible. At the yard the pipe was riveted into lengths of 120 and 160 ft. The shorter lengths were used at the outer end, where the piles would not bear the heavier loading, and near shore, where the wave action would not permit dredging long trenches.

Submarine Joint Simple and Flexible

At the ends of these pieces submarine joints, similar to those used on the intake pipe, at Erie, Pa., were placed. The joint consists of a welded angle and papered ring riveted to one end of the pipe to form the bell, and a flat ring riveted to the other end, with a lead gasket and a loose angle-ring follower to form the spigot. Bolts through the angle rings draw the gasket between the flat ring and the sides and hub of the bell. This gives a tight and slightly flexible joint. A slip joint to take up expansionwas provided where the land and lake sections of the line join.

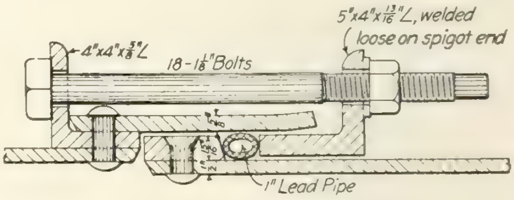
The line ends in a three-way tee, having one 66-in. and two 38-in. outlets. This tee is placed in a crib to protect it from anchors and raise the discharge above the bottom of the lake. The crib is 46 ft. square and 24 ft. high. It is built of 12 x 12-in. timbers, and divided into twenty-five pockets. These were filled with stone, except where occupied by the pipe, and the crib was surrounded with riprap. The sills of the crib are 4 ft. below the bottom of the lake and the top is 26 ft. below low water.

Hydraulic Dredge Digs Trench

An 8-ft. trench was excavated by a hydraulic dredge to allow 2½ ft. of cover over the pipe. No attempt was made to excavate holes for the joints, as it was found to be more satisfactory to do this with a jet as the pipe was laid. In the excavation it was found that the fine sand would stand on a 1:1 slope. Where clay was mixed with the sand the slope was 4:1.

Work started at the crib and progressed toward shore. After the excavation was made the location of the crib was marked on three sides with piles. The crib was towed to position and suspended by cables from two derrick scows, and the pockets were filled with stone. It was then gradually lowered to place.

To lay a section of pipe a buck of four piles was driven at each end of the section. These piles were built up of three 5 x 12-in. timbers, were driven 10 or 12 ft. in the ground and extended 10 ft. above water. They were driven on 14-ft. centres and the tops were drawn to 10-ft. caps to give stiffness. They were capped across the pipe line with round timbers, and the two bents were tied together along the line with 2 x 8-in. plank, on which other plank were laid to form a working platform. On the caps another round timber was set, parallel with and over the line of the pipe. A set of Manilla rope falls was hung from the upper cap on a U-bolt. When the rigging was in place a pipe section, which had been bulkheaded and launched at the yard, was towed to position between the piles, and cables were placed around each end of it and shackled to the lower block of the falls. Valves in the bulkheads were then opened and the pipe was filled with water, after which the tackles were slackened off by hand and the pipe was lowered to place. When near grade a diver descended, removed the bulkheads and directed the work from below. A line from the middle of the pipe extending to the forward pile buck, was held taut as the pipe descended, swinging the pipe endways away from the bell already on the bottom. When at grade this line was slacked and the spigot slipped into the bell. The bolts were entered by the diver, but the nuts were

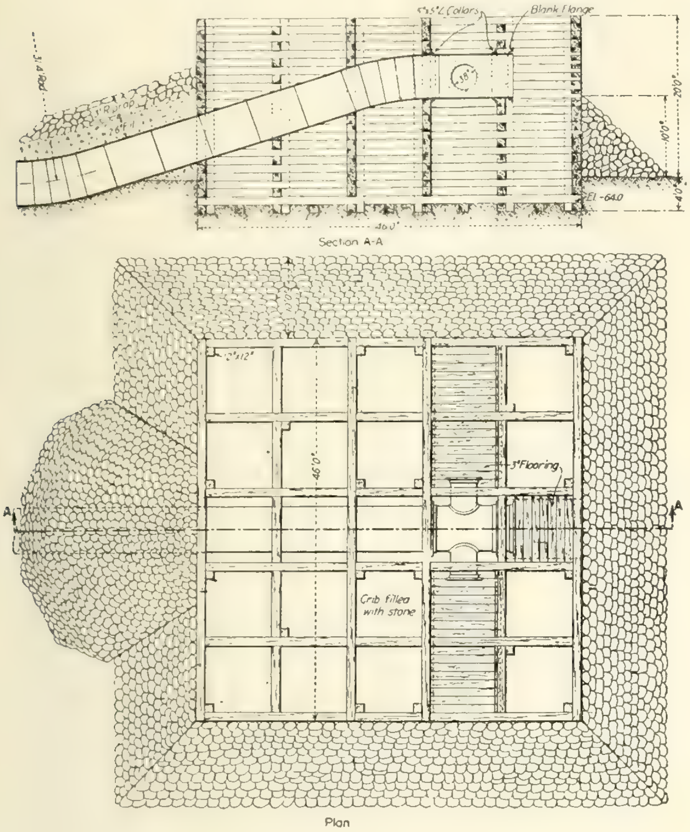


Joint easy to connect under water.

drawn up by men at the surface with a tackle attached to a ratchet wrench.

To permit the removal of all tackle before backfilling, a cable was passed under the free end of each section of pipe and drawn up to the caps with eyebolts. After the backfill had settled these cables were removed and the piles pulled.

The work was done by the T. A. Gillespie Company and completed in fourteen months. The contract price, which included furnishing and laying both the land and lake sections, was $250,000.



Stone-filled crib protects end of discharge from disposal plant.

Paving by Compressed Air

We are indebted to our Australian contemporary Building for the following:—

A German engineer, Herr Wegener, has recently designed a machine for use in streets where the pavement consists of stone cubes. In shape it resembles an ordinary hand ram with two handles which serve as guides. It is worked by compressed air which is generated in a movable compressor plant, the compressor of which is driven by a benzine or benzol motor. The same motor serves for driving the car carrying the plant to and from the place of working. The compressed air is transmitted to the ram by means of india-rubber hoses, having a length of 50 ft. and at a pressure of from 85 lb. to 100 lb. per square inch. The top of the ram contains a valve which is shut or opened by means of a hand lever, and thus regulates the admission of air into a piston with a hollow piston-rod which is contained in the interior of the ram. By pressing down the valves, the piston, by means of the compressed air which enters, is forced down until it rests on the pavement, and by doing so lifts the whole ram. Immediately, however, upon the hand lever being again released, the compressed air which has collected above the piston escapes into the open air by means of an exhaust and the ram falls down upon the pavement.

This fall of the ram can be regulated as required, and its removal from one stone cube to another is very easily effected. The number of strokes to be given with the machine averages 80 per minute. The engine plant is made in three different sizes, for one, two or three rams. For three rams a motor of 18 horse-power is required. The car which carries the plant can travel at the rate of about four miles per hour. Both the motor and the compressor are cooled by means of a cooling pump, for which purpose a separate water car is provided. In addition to the machinery proper, the car contains a small filing bench with a vice, also drums for the hoses. For the smaller plants a motor of from 10 to 12 horsepower is sufficient.

The cost of paving by means of these compressed air machines is about 2½d. for every square metre, or 10.764 square feet. By using crude oil or petrol motors, however, this cost can be still further reduced. With one ram, 1076 square feet of pavement can be easily rammed down in one working day.

Oil Paints for Concrete Floors

INSTANCES are on record where oil-pigment paints have been effectively used to stop the dusting of cement floors brought about by abrasion. If the floor has been freshly laid and is damp, the possibility of lime reaction (saponifying the oil in the paint) may be removed by first treating the surface with a solution of tinted zinc sulphate as a primer.

Boiled linseed oil, sometimes mixed with Chinese wood oil, may be used as the liquid portion of the paint. These oils have a remarkable binding action when applied to a cement surface. When mixed with pigment, they form paints which are eminently suited as first coaters for cement floors. The first coat will dry rapidly and form a dense surface. Over this may be applied a second coat, and, if a high gloss surface is desired, a portion of varnish may be added to this final coat.

In a laboratory built three years ago for experiments in connection with the paint industry, the cement floors were treated in the manner above described, one week after the concrete was in place. The zinc-sulphate primer was used only upon the damp areas. The floors have since been subjected to much abrasion from constant walking and the moving of heavy apparatus. Oils and chemicals of various kinds have come in contact with the floors, and soap and water have been used upon them very often for cleaning purposes. After three years' service, the floors have not dusted and have never required repainting. The paint films are still in good condition. This service record would tend to show that placed Portland cement may be made dust-proof, wear-proof, and highly desirable as a flooring material, by the application of oil paints.

Care must be taken to prevent work from being thrown out of plumb by swelling of lumber in forms. If the forms spring out of place the concrete may flow out and be wasted. At best any springing of the forms will injure the appearance of the surface of the finished structure.

Asphalt: Its Application in Road and Sanitary Work

By N. Hoskins

THE subject of asphalt and bitumen has been so much discussed recently in the technical press that I almost owe an apology for not allowing the matter to rest. I ask to be excused, however, on the grounds that they have not been fully treated in relation to their use in sanitary work in particular, and the nature of the materials under various conditions is not fully understood.

NOMENCLATURE

The subject cannot be even superficially treated without first differentiating between asphalt and bitumen, their allied compounds and their substitutes. Many of the terms used are very loosely applied, and it is hoped that the "Glossary of Road Terms" recently compiled by Mr. H. Percy Boulnois will be the means of bringing about an understanding among manufacturers and users of these important materials. It is a common practice for the "man in the street" to speak of tar paving as asphalt, or maybe, "ashfelt."

Without claiming originality or attempting to criticise the publication just referred to, the following interpretations are intended to apply to this paper:—

Asphalt.—A general term applying to any and every description of asphalt or crude bitumen.

Rock Asphalt.—Limestone or sandstone naturally impregnated with bitumen.

Lake Asphalt.—Crude bitumen.

Compressed Asphalt.—Pulverized rock asphalt heated and consolidated under pressure.

Mastic Asphalt.—A preparation of rock asphalt and additional bitumen, with or without an admixture of coarse sand or grit.

Artificial Asphalt.—A mixture of pulverized limestone and grit made plastic with bitumen.

Bitumen.—A mixture of hydrocarbons in a solid or viscous state which are wholly soluble in carbon bisulphide and almost insoluble in alcohol.

Maltha.—Crude bitumen in a semi-fluid condition.

Pitch.—The residuum from the distillation of coal tar, wood tar, &c.

Bituminous Mastic.—Any mixture composed of pulverized stone or grit made plastic with or containing pitch or tar products.

Origin of Bitumen.—Many theories have been advanced as to the origin of bitumen in nature. It is so closely allied to petroleum in composition that the formation of one cannot be considered without reference to the other. Parkes' "Chemical Catechism" states "naptha is a fluid and transparent as water; but when exposed to the air it becomes yellow, and then brown; its consistence is increased, and it passes into petroleum. Petroleum is found native in many countries, and by an exposure to the air becomes mineral tar. Mineral tar is also found native which by exposure to the air passes into mineral pitch and maltha. By further induration this passes into asphaltum, which substance is likewise found native in many parts of the world." It will be seen, therefore, that to arrive at the formation of bitumen and asphalt we must first consider the origin of naphtha. The word naphtha is derived from the Persian "nafta," to ooze out, but in this country the word is usually confined to a distillation from coal tar or wood tar; it is sometimes used, however, for one of the fractions of petroleum. Petroleum (from Latin petra, rock, and oleum, oil) occurs in enormous quantities in some very ancient rocks (Silurian and Carboniferous), and also in much later deposits (early Tertiary), and it is evident from its chemical composition that it is of organic origin. Accumulations of vegetable and animal organic matter which under certain conditions would have resulted in peat and finally coal have, as the result of peculiar circumstances, passed through various stages of decomposition by the influence of what has become known as "marsh gas" bacteria and been converted into a liquid.

Principal Deposits of Bitumen.—The island of Trinidad, British West Indies, is noted for the most remarkable deposit. Here in the south-west portion of the island is the famous "Pitch Lake," so named by Sir Walter Raleigh, who discovered it in 1595. He noted that the lake contained "abundance of stone pitch, that all the shippes of the world might therewith be laden from thence, and we made trial of it in trimming our shippes, to be most excellent good and melteth not with the sun as the pitch of Norway." The lake has many peculiarities. It covers about 100 acres, is roughly circular in shape, probably occupying the crater of an extinct volcano, and is of unknown depth. In 1893 an attempt was made to determine its depth at the centre by boring, but after sinking to a depth of 135 ft. the tubes had inclined to such an angle that the attempt had to be abandoned.

The lake has been worked under a concession granted by the British Government for some twenty-seven years, during which period some millious of tons of the material have been exported, the bulk of it going to the United States, but large quantities being shipped to England by Messrs. Previte and Company, of London. The crude material is dug from the surface of the lake, and although several tons may be removed in a single day, within thirty-six hours the excavations are said to refill by the natural pressure from below. The material is taken in iron skips to an aerial railway, which conveys it to the sea, some 800 yards distant, for shipping. Asphalt is also found beyond the boundary of the lake, especially between the lake and the sea. This is termed land asphalt. It is questionable how it got there, but the supposition is that the lake at some early date overflowed its banks. Although the physical properties of the asphalt vary considerably, even in the lake itself, as may be seen by the specimens exhibited, the chemical composition is extremely uniform.

Before the crude asphalt can pass to any of the many uses for which it may be intended it must undergo a process of refining, as it contains some 30 per cent. of water besides organic matter, which it is necessary to eliminate. This is usually done in tanks about 15 ft. deep filled with coils of 1¼ in. pipes about 6 in. apart. The coils carry steam at 100 lb. pressure, corresponding to a temperature of about 325 deg. Fah. At this temperature the asphalt, which is liquid, is run into casks, and is known as epure. In this condition it is ready to be converted by the addition of a flux into what is called for trade purposes "refined Trinidad Lake bitumen."

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* Abstract of a paper read in London before the Institute of Sanitary Engineers.

Another extensive deposit of lake asphalt is that at Venezuela, Bermudez. This covers an area of some 1000 acres, but is very shallow compared with the Trinidad lake. It varies in consistency in different parts of the lake from viscous maltha to solid bitumen. The crude material is richer in bitumen than that of Trinidad, but the composition of the refined bitumen is not identical in each. Deposits are also found is Cuba and other parts of the world.

Rock Asphalt.—Rock asphalt is entirely different both physically and chemically from lake asphalt; in fact, the only thing common to each is that they both contain bitumen. The following is a comparison:—

Diversities of Lake and Rock Asphalts

	Trinidad Lake. (Dry.)	Rock. (Seyssel.)
Specific gravity	1.4	2.25
Hardness	Plastic	Tough
Inflammability	Inflammable	Fire-resisting
Fracture	Conchoidal	Rough
Melting point	170 deg. Fah.	(Disintegrates)
Bitumen content	54	8
Calcium carbonate	—	91
Sulphus	3	—
Mineral matter (Silica)	35	—
Organic matter	8	—

Rock asphalt is correctly described as a limestone naturally impregnated with from 6 to 14 per cent. of bitumen, which gives it a rich brown colour. When the bitumen is extracted by means of a solvent the limestone is left in a state of very fine subdivision, and we might consider briefly how the stone became impregnated. Few rocks vary more in texture and composition than limestone; it may be a friable chalk-like deposit, a finely-grained rock resembling sandstone, or a hard, close-grained mass having a conchoidal fracture. In rock asphalt we have an example of a finely-grained deposit, the particles being cemented together, as it were, with what would first appear a foreign matter. The deposits are found in various thicknesses, 6 ft. and less to over 20 ft., and are at times laminated. The existence of laminae indicates tranquil conditions of intermittent deposit, and such thin layers occur only where the mineral is fine-grained, as in mud or shale. The alteration of thin bands of laminated rock with others non-laminated indicates considerable oscillation of currents from various quarters bearing different quantities and qualities of sediment.

The conditions favourable to the formation, or rather to the impregnation of limestone with bitumen, are the diffusion of organic material, either vegetable or animal, through the finely divided calcareous deposit and the exclusion of air from the material undergoing decomposition. There is reason to believe that no more heat was required than that afforded by the process of fermentation to bring about the changes by the aid of anaerobic bacteria. It is probable that the organic matter was in the form of delicate water plants, together with abundant infusorial or microscopic vegetable life. That the unimpregnated laminae should exist between the impregnated rock is conclusive proof that the bitumen-forming agents must have been entombed in the lime deposit, and that the impregnation was not brought about by external examinations, as is sometimes suggested.

Principal Deposits of Rock Asphalt.—Rock asphalt appears to have been discovered in the Val de Travers, Switzerland, by a workman named Jost, who brought it to the notice of a Greek physician named Eyrinis in 1712, and he was granted a concession by the King of Prussia to work the rock. However, the credit is, I believe, due to Count Sassenay for starting the asphalt industry on business lines and correcting mistakes made by Eyrinis, mentioned hereafter. In 1802 Count Sassenay secured the concession of the Seyssel Mine, and carefully investigated the properties of the rock and trained his workmen in the proper methods of using it. The principal deposits on the Continent which are used in this country are found at Val de Travers (Switzerland), Limmer and Vorwohle (Germany), Pyrimont, Seyssel (France), Ragusa (Sicily). The rock is quarried or mined according to whether the seam is near or far below the surface of the ground. As previously stated, the seams vary in thickness; they also vary considerably in texture and composition, even from the same quarry.

Mastic Asphalt.—Mastic asphalt is a mechanical mixture made by intimately compounding powdered rock asphalt with additional bitumen and with or without an admixture of coarse grit. The process of manufacture of mastic asphalt, as carried out by one or more well-known firms, and may for our purpose be accepted as the method generally adopted, is to first crush the natural rock to pieces about the size of walnuts. After passing through the crusher the asphalt is carried up by elevators to a disintegrator, which runs at a high speed, grinding the material to a fine powder. The powder is then cooked in specially-made cauldrons, worked by agitators, with certain proportions of bitumen, and when heated to a temperature of about 400 deg. Fah., a proportion of from 10 to 20 per cent. of fine grit is added to make gritted mastic, and which is thoroughly incorporated with the asphalt by the rotary working of the agitators. It is then turned out into iron moulds and made into blocks of various shapes weighing about ½ cwt. each. To apply the mastic, these cakes are broken into small pieces and carefully placed in a cauldron with just sufficient bitumen as a flux. It is then heated to a temperature of about 280 deg. Fah., the whole being carefully stirred until properly cooked. When ready it is taken from the cauldron with an iron bucket and spread by means of hand floats to the required thickness and rubbed with fine sand. As the mastic is likely to have blowholes, it is important that it should be applied in two coats where required for damp-proofing.

Tests for Asphalt.—The following tests are such as may be applied by an engineer or architect, but it is pointed out that special apparatus, as also an intimate knowledge of analytical chemistry, is necessary to determine the exact composition of the materials we are now considering. Much useful information on this subject is contained in "Natural Rock Asphalts and Bitumens," by Arthur Danby, who has kindly permitted the author to cull some of the following tests:—A simple method to adopt in order to tell one artificial bitumen from another consists in holding the product over an open flame and smelling the vapours which are given off. The residue from coal tar, wood tar, turf tar, or stearin, each of which has its own distinctive odour, is easily noticeable when the material is heated. A definite test for the presence of coal tar pitch in a suspected material is based on the fact that it contains a quantity of free carbon in contrast with the natural bitumen, which contains none. Natural bitumen presents a uniform brownish appearance when a little is fused on a microscope slide and examined under a microscope. In an adulterated sample the free carbon may be seen suspended in the bituminous matter like small black dots, though to the naked eye the mass appears to be true bitumen. Mastic should be able to be cut with a knife. If too hard or stony a nature it proves an insufficiency of bitumen. When held in a gas flame it should soften, it should never run or begin to ignite. If it burns, the mastic contains too much flux, and for practical purposes the material will prove too soft.

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*Abstract of a paper read in London before the Institute of Sanitary Engineers.

Application of Rock Asphalt.—As a material for paving streets asphalt has much to recommend it from a sanitary point of view. It is non-absorbent, easily cleansed, and suffers no material change from variations of temperature. Its suitability for this purpose was discovered by accident in 1849. Fragments of asphalt dropping from the carts which transported it from the quarry along the road became heated by the sun and were crushed to powder and compacted by the continual passage of the carts until a hard, smooth track was formed. The phenomenon thus presented, followed by many experiments, led to the perfect method of constructing the rock asphalt road now in use. In 1854 the first street of compressed asphalt was laid in Paris, and covered an area of 950 square yards. The first street to be so treated in London was Theadneedle-street in 1869. Rock asphalt may be utilised for road paving either as macadam, compressed powder, or as compressed tiles. As a macadam it would appear not to have been quite satisfactory, judging from the report on the Eltham-Sidcup trial road, but the author constructed an asphalt macadam road several years ago which gave satisfaction. For compressed work, the rock is prepared by heating the powder in revolving cylinders to a temperature of 280 deg. Fah., and as soon as the moisture has evaporated the heated powder is placed in iron-lined vans and taken to the street where it is to be laid. The powder is then raked over the prepared concrete surface to the thickness required and rammed with hot pelons, smoothed to a polished surface, and then rolled with a heavy hand roller. It gradually becomes cold, and in time is compressed into solid rock again by the traffic. The usual thickness of compressed asphalt is 2 in. for heavy and 1½ in. for light traffic. It is essential that compressed asphalt should be laid on a foundation of good Portland cement concrete about 6 in. thick. Neglect in this respect has been the cause of many failures.

Application of Mastic Asphalt.—Mastic asphalt is a most useful and efficient material, and is eminently suited to meet certain sanitary requirements. It is damp-proof, fire-resisting, vermin-proof, durable, has certain antiseptic properties, and is easily applied by a skilled hand to roofs, floors, walls, and for a variety of purposes in engineering and building works.

Damp-proof Courses.—To resist damp no better material exists than asphalt or bitumen properly applied. Clause 20 of the Model By-laws issued by the Local Government Board requires that every wall or pier of a new building shall have a proper damp-proof course of sheet lead, asphalt or slates laid in cement or other not less durable material impervious to moisture beneath the level of the lowest floor timbers and at a height of not less than 6 ins. above the adjoining ground. The by-law is quite clear, but the loose method of applying the terms "asphalted" and "bituminous" to felts treated with coal tar products tends to bring the genuine article into disrepute; so much so that a circular was recently issued to builders by the District Surveyors in London stating that "the material commonly known as 'felt damp-course,' asphalted felt or similar material, will not be approved unless a distinct and sufficient layer of natural asphalt or bitumen is provided in connection therewith." This cheap substitute for the genuine article cannot be too strongly condemned. No asphalt or bitumen is used in its manufacture and the fibrous material employed is subject to rapid decay in damp situations. The author knows of extensive property in London which is in a very unsatisfactory condition owing to this worthless material having been used, and frequently replaced it in existing buildings with a genuine damp-proof course at great expense to the owners. This, however, is the only remedy. With respect to the fire-resisting properties of mastic asphalt, much will depend on the quantity of bitumen it contains, the latter material being highly inflammable. It is not only the spread of the fire and the stability of the building that must be considered in case of fire occurring, although these are important factors; but the danger to the firemen employed in its extinction by falling debris. The London Building Act, 1894, Sec. 61, states that the flat, gutter, and roof of every building, &c., shall be externally covered with slates, tiles, metal or other incombustible materials. It would appear from a recent circular that the London County Council does not consider asphalt an incombustible material. It should be pointed out, however, that it if far more so than some of the metals, e.g., lead and zinc, which are permitted by the Building Act.

Application of Bitumen Sheeting.—For several years past bitumen sheeting has been used for waterproofing purposes, more particularly for horizontal damp-proof courses, lining of reservoirs, sewage tanks, filter beds, swimming baths, &c., with great success. The sheeting is manufactured by coating jute cloth on either side with a heavy layer of bitumen. It is made in standard-size sheets, each measuring 24 ft. by 6 ft., and is about 3/16 in. thick. It has the advantage of being more easily laid than mastic asphalt. It is not suited for vertical work unless supported on the outer face. The most satisfactory method of fixing in a vertical position, as in the case of reservoirs, &c., is by the use of special wall ties, which are built into both the inner and outer walls. To fix the material in a horizontal position the sheets should be carefully unrolled and laid over the surface to be covered, due allowance being made for a 3-in. lap at the joints. The sheeting should then be left for a few hours in order that it may take a proper bearing before jointing. A special jointing iron is then heated and carefully passed between the laps to soften the bitumen on the inner surfaces, and these should promptly be united with a wooden mallet.

Causes of Failure in Asphalt Work.—The causes of failure are usually due to either the material used or the method of using it. These may be guarded against to a great extent by entrusting the work to a reputable firm. There are few materials which lend themselves to adulteration more than asphalt, and few which require more careful manipulation. Large quantities of low-priced mastic have been imported to this country from Germany and still larger quantities are "faked" here during their preparation and use. The author contends that the work to be done, however small the job may be, should be executed by the firm's own workmen. The mastic blocks should bear the brand of the firm, and no other material should be allowed to be mixed with them except the bitumen flux.

Repair of Defects in Reinforced Concrete

A comprehensive review of methods which have been employed to repair cracked elements of reinforced-concrete structures was given some time ago by Prof. S. Muller before the Deutsche Beton Verein, and is reported by The Engineering News. His account was based on extensive experiences in carrying out such repair or reinforcement, chiefly of floor slabs and beams.

The defects in question include weakness of the slab due to inadequate thickness for proper service as compression element of the T-beam; separation of slab from beam; and diagonal or horizontal cracking of the beam web. Vertical cracking, which sometimes occurs, is due to shrinkage and is not considered dangerous.

Beams

In the earliest repair jobs on defective beams the plan adopted was to strengthen the floor by adding supplementary beams or by setting a column under the middle of the weak beam. In some cases a pair of I-beams has been placed alongside the weak concrete beam; but this is generally uneconomical, because the uncertainty of the load distribution makes it necessary to proportion the steel beams to take the entire load. Diagonal cracking, indicating a deficiency of shear reinforcement, has been repaired by placing vertical or inclined steel stirrups around the web of the beam and screwing them up tight. This method did not always prove satisfactory, however, especially in structures subject to vibration. The best method of repair yet developed is to place cramps over the crack, doweled into the sound concrete on both sides, and incase them in a shell of concrete, for which space may be made by chipping off the original concrete for a depth of an inch or so.

Slabs

Where a slab requires to be reinforced, to provide additional compression area for T-beam action, a good bond of the new top layer has generally been obtained. Thorough cleaning of the surface is first necessary, followed by roughening the old concrete by picking or otherwise; after wetting the surface, a 2-in. layer of concrete well reinforced by a strong mesh is placed. The mesh should be tied to the reinforcement of the old concrete by steel-tie members.

Where slab and beam have separated the scheme has been employed of adding such a reinforced upper layer on top of the slab and tying this down through holes in the slab to cross-bars passed through holes in the stem of the beam.

It has been found that painstaking work is necessary for success in repairing reinforced-concrete structures. With care, however, the patches or new elements can be made structurally integral with the old parts. Satisfactory appearance can be secured. In the best work the patches are practically invisible.

Will Mixing Concrete Too Wet Cause Its Failure?

IN an interesting discussion of this subject published in a recent issue of Concrete-Cement Age, Mr. C. H. Fuller, an engineering-contractor of Corinth, Miss., contributes the following:

"In the earlier days the tendency was to mix all concrete too dry and sidewalk and concrete block people still adhere to that practice, with the result that their products do not attain the strength of the wetter mixtures. Now the tendency, owing largely to the chuting systems of deposition in forms, is causing the pendulum of opinion to swing in the other direction and many contractors are mixing too wet, something that one is easily tempted to do because it facilitates the handling of the material.

"Mixing concrete is a chemical process and if sufficient water is not added at the time it is mixed, the cement not only fails to become thoroughly mixed with the balance of the material but from lack of water at the initial moment fails to attain the adhesive strength it should. On the other hand the addition of too much water causes the cement to segregate and separate from the heavier material and this is especially true in chuting systems. The exact proportion of water causes it to adhere and cling to the heavier material until it is all deposited in an even mass in the forms and from its weight the excess of moisture is removed. To get perfect concrete, just enough water should be added to make a thoroughly creamy consistent mixture in which every unit of the heavier material is thoroughly coated with cement and in which the heaviest stones will float and set without settling to the bottom. This kind of a mixture is easy to tamp, does not flow quite so readily in the chutes, requires more mixing and has a tendency to clog the mixer and tools but produces very little sweating or leaking of forms. While I have not had an opportunity to test samples of such concrete for comparison in the tensile and the crushing machines, I am convinced from observations in cutting holes in walls and mass masonry and in the destruction of concrete structures that the evenly mixed concrete is the strongest, and no concrete can be moved from the mixer and deposited in the forms and remain evenly mixed if there is too much water in it.

"On any large job, where the operations were sufficiently diversified, any one who knew just what he was looking for and equipped with a good camera would in a few days of watching pick up a number of photographs, the comparison of which would convince any rational minded man that the quantity of water plays an important part in the mixing of concrete. With a dozen or more photographs, such as I have in mind, I believe that I could put up a convincing argument along this line."

A suggestive paper contributed to the annual meeting of the American Concrete Institute by Mr. N. C. Johnson dealt with micro-photography as applied to the examination of concrete, with the object of obtaining better knowledge of the structure of the material itself. A fact particularly mentioned by the author was that all specimens of concrete examined by him possessed a surprisingly large quantity of unhydrated cement, a feature he attributes to the difficulty in diffusing the water completely during the process of mixing. The voids revealed by the microscope also emphasize the importance of scientific grading.

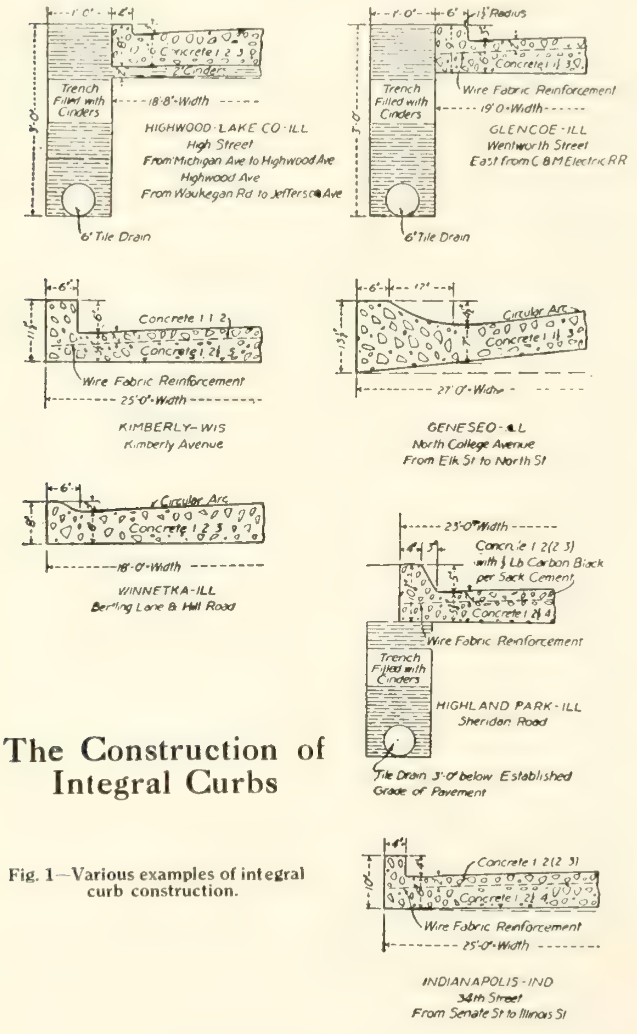
The Construction of Integral Curbs[*]

A Method of Pouring Curb and Pavement in one Monolithic Mass, whereby the Cost of the Improvement is Materially Reduced.

By Chas. E. Russell[†]

ALL street pavements call for some form of curb and gutter, the cost of which to property owners usually amounts to from 45 to 90 cents per linear foot of street frontage, an expenditure often equivalent to 25 per cent. of the cost of the pavement proper.

The cost of a proposed type of improvement often eliminates it from consideration, and forces property owners to substitute an inferior type. There have been numerous cases where concrete pavements have been rejected for inferior and cheaper pavements, when the property owners would gladly have accepted concrete if it could have been reduced from 10 to 15 per cent. in cost. This reduction in cost can be made by the adoption of the integral concrete curb—that is, one moulded as a part of the pavement.



The Construction of Integral Curbs

Fig. 1—Various examples of integral curb construction.

During the last year successful demonstration has been made that integral curb reduces the cost at least 60 per cent. for a 6 by 6-in. curb projection, while larger saving can be shown for smaller curbs and for gutter depressions. This being true, the integral curb deserves thought and investigation by engineers and others interested in paving work, even though they do not immediately recognize its merits.

During the last year several distinct types of curb and gutter were built successfully, each type designed to suit the scheme of landscape and local conditions. Fig. 1 shows the designs of curb on pavements at Highwood, Glencoe, Winnetka, Highland Park, and Geneseo, Ill.; Kimberly, Wis.; and Indianapolis, Ind.

The types of curb, or rather gutter, built at Geneseo and Winnetka, Ill., are well adapted to boulevards, park systems, suburban residence streets, and lanes. These may be formed by shaping tre ends of the strike-board to the desired curvature. Cost can be estimated on the basis of additional square yardage of pavement, which generally amounts to from 3 to 5 cents per lin. ft. of curb, when the cost of curb joint construction, including filler, is deducted.

The type of curb built on Sheridan Road at Highland Park, Ill., in 1914, is the kind that would be suited to the average street. More concrete is required, and a curb form must be used. Cost would be estimated at about 18 cents per lin. ft. of curb, which was about the actual cost of the Sheridan Road work.

Integral curb, being a part of the pavement and composed of the pavement concrete mixture (which is of a rich mixture) reinforced by turning the pavement reinforcement up into the curb form, naturally results in a curb stronger than the average; and such construction cannot tip over or be forced out of alignment. It serves its purpose as a curb without doubt, and as well as any other type.

An objection which has been advanced is that the integral curb is difficult to construct. Such objections are common to all new types of construction until contractors become familiar with methods, and therefore should in no way discredit the integral curb; in fact, the manner in which the problem was handled on the first jobs of this kind indicates that a satisfactory and economical method of construction can be evolved.

The essential requirements for the construction of integral curb are complete bond with the pavement, perfect alignment, good surface finish, clean joint coinciding with the pavement transverse expansion joint, and simple, inexpensive forms. When forms are devised that will meet with the above requirements there can be no objection to the integral curb.

Should each contractor, without previous knowledge or experience, endeavour to construct integral curb with forms of his own devising, it would probably be some time before perfectly satisfactory integral curb would be built to any extent. In the meantime this desirable economic construction would be discounted or discarded.. If, on the other hand, we place before those who are inexperienced a form which at least has some merit, and which is designed on the fundamental principles stated herein, they should be better able to construct a more satisfactory job and at a more reasonable price; furthermore, each time a form is used, some improvement will be made in it; and it will be but a short time before the best forms are evolved, and then the integral curb will become a standard with concrete pavement.

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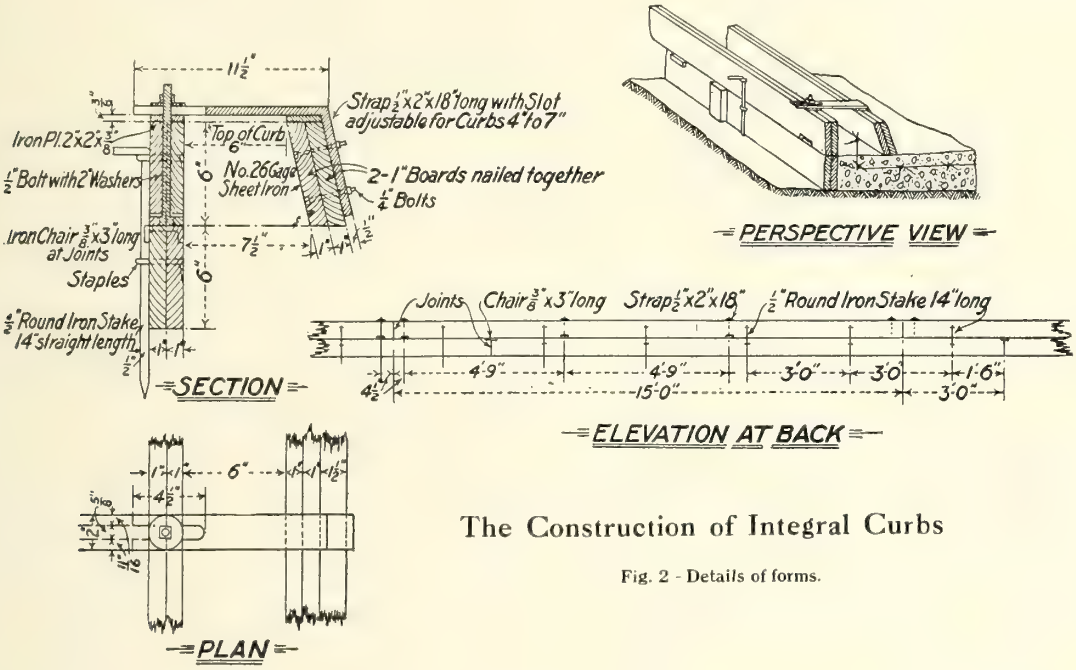
[*] Paper presented to the American Concrete Institute.

[†] City Engineer, Highland Park, Ill.

A design for integral curb forms is shown in Fig. 2. This is presented as a suggestion, and it is hoped it may be of help to those in this field of construction, and that each one who is interested in integral curb will study the design and improve upon it.

Taking up the essential requirements of integral curb construction as previously given, we shall not analyze them in connection with the suggested forms. For economic construction, the curb must be made of the concrete of which the pavement is composed. Such concrete will be of quaky consistency, and probably of the proportions 1:2:3, with the coarse aggregate up to 1½ ins. in size. Pavement side forms are staked into position, concrete dumped between them and then struck off, just as in any concrete road work. Within fifteen minutes after the pavement is struck off the curb forms are set and filled. Complete bond is obtained by roughening the concrete at the bottom of the curb form by running a mason's trowel or a stick along through it just before the concrete fill is made. Pavement reinforcement turned up into the curb also assists in strengthening the bond. The form for the back of curb is set upon the top of the pavement form, and held snugly to it by pins run through staples in both forms, and driven into the ground. The front form is held to the back one by adjustable iron strap clamps which permit perfect alignment of the front form after being set up in place. Warping of forms is also minimized by using 1 by 6-in. lumber nailed tightly together, with nails clinched.



The Construction of Integral Curbs

Fig. 2 - Details of forms.

When the concrete fill is made, it should be worked to get a compact mass. This is best done by spading it with a shovel, after which a mason's trowel or a blade similar to a corn-harvesting knife should be run along against the front form, to cut the coarse aggregate away from the form and thus work the mortar to the face. The front form is lined with sheet iron so that a smooth face is obtained without further trowelling. The top can be edged and finished readily while the forms are in place. No work will be done on the curb after the forms are removed, except touching up defective spots.

Expansion joints are required in the curb at and coinciding with transverse expansion joints in the pavement. These must be exactly over the joints in the pavements, for if they are not the curb at these places will be likely to spall off.

Since a concrete of quaky consistency is to be used, forms must be left in place at least three hours. This will necessitate having on hand about two or three hundred linear feet of forms. These, however, are of simple construction, and inexpensive. Fifty dollars will cover the cost of forms with which to lay at least 600 lin. ft. of curb a day.

Admitting that most of us are likely to find objections to this new type of curb, we cannot conscientiously cast the idea of integral curbs from our minds, because its adoption will create a saving of approximately 60 per cent. of the cost compared with independent curb.

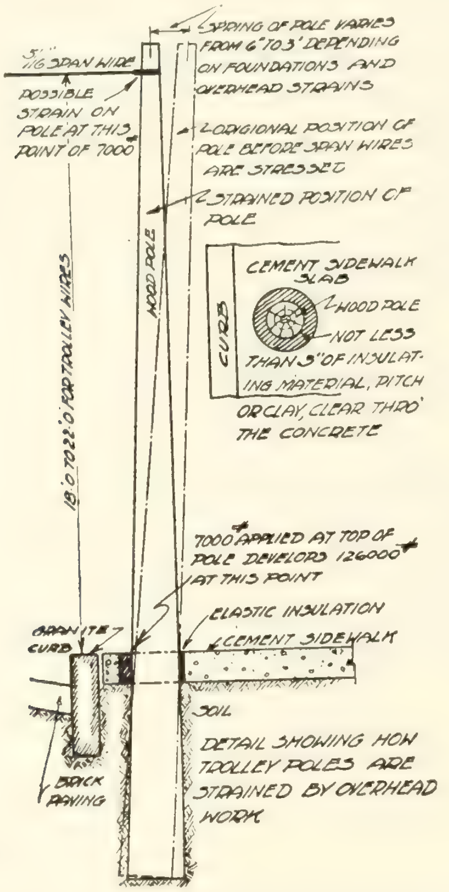
In answer to a question as to whether the curb is poured at the same time as the rest of the pavement, and whether there is any trouble in striking off the road when building the curb, Mr. Russell replied:

"The road is first struck off before putting on the inside form. After the road is crowned, and before it is floated, the inside form is placed, and then filled with the same mixture of concrete as is used in the top course of the pavement. That is smoothed off, and after it has set sufficiently it is trowelled."

The amount of polish which can be given to the surface of concrete depends upon the density of the mixture and the nature of the aggregate used. After the surface has been smoothed down on a rubbing bed, or by the use of rotary rubbing stones, as applied in terrazzo floor work, the procedure is somewhat similar to that used in polishing granite or marble. The aggregate exposed on the surface by the rubbing process takes the polish, the appearance of the surface being dependent upon the percentage of aggregate exposed.

Splitting of Concrete Sidewalks Surrounding Iron Posts[*]

IT is not an uncommon sight to see long stretches of concrete sidewalk disfigured by being badly split, checked and broken or curbing pushed out of line where the slab surrounds and comes in contact with trolley poles, public service poles, fire hydrants and such obstructions, which extend through the sidewalk to various depths in the soil below. A little careful consideration of the subject will show these defects to be largely the result of carelessness and incompetence on the part of the mechanic who does the work and to ignorance or indifference on the part of those supervising the work; nor should the contractor be blamed for not taking the necessary precautions under the present methods of competition, when the city or the owner is willing to risk such possible disfigurement in order to effect a very small saving in first cost.


5"/16 SPAN WIRE
SPRING OF POLE VARIES FROM 6" TO 3' DEPENDING ON FOUNDATIONS AND OVERHEAD STRAINS
POSSIBLE STRAIN ON POLE AT THIS POINT OF 7000#
ORIGIONAL POSITION OF POLE BEFORE SPAN WIRES ARE STRESSET
STRAINED POSITION OF POLE
WOOD POLE
18'0 TO 22'0 FOR TROLLEY WIRES
CEMENT SIDEWALK SLAB
CURB
WOOD POLE
NOT LESS THAN 3" OF INSULATING MATERIAL, PITCH OR CLAY, CLEAR THRO' THE CONCRETE
7000# APPLIED AT TOP OF POLE DEVELOPS 126000# AT THIS POINT
ELASTIC INSULATION
GRANITE CURB
CEMENT SIDEWALK
SOIL
BRICK PAVING
DETAIL SHOWING HOW TROLLEY POLES ARE STRAINED BY OVERHEAD WORK

Sketch showing concrete sidewalk surrounding trolley pole.

The writer has long been an advocate of three feet or more of street lawn between the curbing and the edge of the sidewalk, which not only provides sufficient space for these inevitable obstructions, where they will do the minimum of damage, but affords an opportunity to beautify the street by planting trees. However, there are many places in every town, where the sidewalks, of necessity, extend from the crub to the building, and in such locations the application of a little common sense and some slight additional expense, infinitesimal when compared with the results obtained, will eliminate nine-tenths of such unsightly defects, if applied when the sidewalk is laid or when holes are cut in old sidewalks for new poles.

The causes of the trouble differ, depending on the object set through the walk and the purpose for which it is put there, but the resulting effect, the destruction of the walk, is the same in any case and the remedy, described later, is simple.

Usually the street railway company's trolley poles are the most destructive of all of these obstructions and the reason is not far to seek, if we take our attention from the sidewalk itself, for a few moments, and consider their purposes and methods of erection. Usually these are of wood, generally untreated (which is immaterial, any way) and therefore subject to considerable shrinkage or expansion owing to atmospheric changes. One who has not given the subject much thought may object that a wood pole alternately dry or saturated by rain would not swell sufficiently to check and break the surrounding slab of concrete. As evidence to the contrary, one of the methods of quarrying fine building stone is to drill a row of holes along the desired line of cleavage, sometimes several feet in depth, plug them with kiln-dried wood plugs, then saturate these plugs with water. This process will split huge slabs of the hardest granite, so what chance has the poor, thin little slab of concrete, against the destructive force generated by a swelling pole?

There is another factor of still greater destructive tendency, regardless of whether the pole be of iron or of wood, and that is the enormous strains induced by what the street railway man calls his overhead work. The pole-setting gang sets the pole with a slight inclination away from the trolley, sometimes as much as three feet from the perpendicular at the top, as shown in the accompanying illustration. The trolley or line crew then connects these poles together in pairs, by a 3/16-in. or a 5/16-in. stranded wire cable some 18 ft. or 22 ft. from the ground, and by means of tackle strains these poles into a plumb position. On high-class work the pole man frequently fills the hole in which the pole is set with a low grade concrete, to give it greater stability, and a 5/16-in. span wire cable at the top is capable of producing a 7,000-lb. pull, which, if the pole is capable of withstanding such a strain, induces a permanent set or spring in the pole with a possible strain or reaction at the point at which it passes through the sidewalk up to 125,000 lbs. The line foreman counts on this resiliency of his poles to take up the slack in the overhead incurred by the expansion and the contraction of the connecting wires. Between the cool of midnight and the heat of noon time, the tops of a pair of trolley poles will vary one foot or more in relation to each other, and this movement to a lesser degree but greatly multiplied in stress effect is communicated to the surrounding slab of sidewalk which is absorbing a shock it was never intended to carry, and being of a comparatively unyielding composition, breaks away at the point of contact.

Telephone and telegraph poles, though stressed in a different manner and more uniformly along their centre line, affect the sidewalk in a lesser degree, but anyone who has seen a thoroughly sound new pole some 12 in. to 20 in. in diameter, sheared off clean at the sidewalk line, from the stressing of numerous overhead wires, will readily appreciate the enormity of these strains which must produce a resultant in the sidewalk or the foundations below it.

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[*] By C. B. Fuller, consulting engineer, Indianoplis, in Concrete-Cement Age.

Sometimes these strains are of a torsional or twisting nature, and the writer has seen one case in which the twisting power of the overhead wiring applied at the top of a 60-ft. pole of 20-in. butt, was sufficient to separate the fibres of the wood at a point within easy reach sufficiently to permit the passing of an ordinary hand axe through the hole without severing a single fibre of the wood. Where such strains are produced, is it any wonder that the sidewalk suffers?

With fire hydrants, the strains are largely temperature strains, but, being connected to the city mains by unyielding cast iron pipe and bedded in the cool earth the rate of expansion differs from and is not coincident with the temperature variations in the thin, flat and exposed sidewalk slab, so that movement does not necessarily take place in the same direction, and so produces destructive results.

There are numerous other poles of different types and purposes, set through the sidewalk, not always connected but all more or less firmly bedded in the underlying soil. The sidewalk slab is bound to move as it expands under the rays of the sun, and as all of these obstructions are opposed to the normal movement of the slab they are destructive in their influence.

As a remedy, when building new sidewalks around such obstructions, the writer usually specifies that a space of approximately three inches be left clear of concrete around them, giving them an opportunity to perform the functions imposed by saturation, overhead strains or expansion, without injury to the walk. This may be readily effected by wrapping several thicknesses of expansion filler around each pole before concreting; or a circle of tin, leaving the desired clearance, may be bent around the pole to make a form against which to finish the concrete. If the latter is used, care should be taken to fill the space between the tin and the pole with clay, sand or pitch to prevent a careless workman from defeating the object of such precautions by disposing of surplus cement in the interstice. When it is desired to prevent the water from centering between the slab and the pole, a soft pitch makes a good insulating material, as it readily accommodates itself to any movement of the pole or the sidewalk.

Where a hole is cut in an old sidewalk for a new pole the same precautions should be taken in patching the paving as outlined for new work.

Where poles have already been set and the sidewalk laid flush with pole, any further development of cracks and checks may be prevented by chipping out a ring of concrete around the pole and filling the interstice with pitch.

It is doubtful that the corrosion of metal embedded in the concrete has any serious influence in making such checks and cracks in the sidewalk. It is a fact that iron or steel when properly protected seldom rusts appreciably, and concrete rich in cement forms a high-grade rust insulation, as evidenced by the bright tool marks found on steel removed from concrete in which it has been embedded for long periods. If the iron poles are insulated from the concrete, as described, the effect of corrosion, other than a slight stain, need not be feared.

The writer does not advocate such insulation as a cure-all for defects in sidewalk work, but experience and observation have demonstrated that the results fully justify such precautions. It is to be regretted that owners and city supervisory forces do not appreciate more fully the necessity of caring for expansion in a less perfunctory way than is customary. Nearly every city engineer has the authority to insist on some such precautions against those unsightly defects, and if he does not incorporate some such features in his specifications, neither the contractor nor the owner at the present stage of the game can be expected to assume the burden of such precautions, slight though the cost may be.

Oil-Proof Reservoirs of Concrete

By Wm. M. Kinney*

So far as the effect of oils on concrete is concerned, the general conclusion, based on the results of tests and actual experience, seems to indicate that mineral oils (under which head may be classed lubricating oils and gasoline) show only a slight tendency to soak into the concrete and perhaps reduce its strength somewhat. The extent of this action, however, depends largely upon the quality of the concrete.

Several engineers have made investigations of concrete structures subject to the effect of engine oil and the like, and have found that in the few cases where there was any evidence of disintegration the concrete itself was of poor quality or the workmanship was inferior. If the concrete exposed to the mineral oils is porous, injured by frost while hardening, of a lean mixture, poorly mixed or improperly cured, there is no doubt that general penetration and weakening of the concrete will result. If, however, the concrete is made of well graded materials, properly proportioned, mixed and placed so as to obtain a dense, compact mass, the oils will have no destructive effect on the concrete.

A concrete tank built in San Antonio, Texas, is reported in Engineering Record of May 30, 1908, as having at that time been in service for three years, holding heavy Texas oil, without showing any leakage whatever.

In Engineering News of July 4, 1907, is reported a concrete tank for fuel oil which was built for the Tonopah Mining Company at Millers, Nev. The tank is built with the top flush with the ground line or a few inches above it in order to prevent any drainage running into it. The inside dimensions are 84 ft. 6 ins. long, 35 ft. wide and 8 ft. deep, the capacity being approximately 145,000 gals., or 4,700 bbls. The walls of the tank are 4 ins. thick and the sides and ends of the tank slope in an angle of 60 degs. with the base. A rim around the upper periphery is 12 ins. x 12 ins. In mixing the concrete, great care was taken to prevent broken stone larger than ¾-in. from entering the mixture, in order that seepage of oil might be prevented. The mixture used was 1 part cement, 1 part sand and 1 part broken stone. Reinforcing bars were used at the inner sections of angle corners only.

In Engineering News, Vol. 57, No. 1, p. 12, is described an experiment made on the use of concrete tanks for storing fuel oil. One tank was made and filled with oil and at the end of nine months the tank was absolutely tight, the oil having penetrated and discolored the concrete less than one-half inch, and the concrete remained apparently sound and uninjured.

Several tanks for storing Texas oils have been constructed by the different railroads at El Paso, Tex. A letter from the El Paso & Southwestern System states that it has used concrete tanks to store crude oil uninterruptedly for five years and finds that the concrete has not been injured in any way.

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*Engineer in charge, Information Bureau, Universal Portland Cement Company, Chicago. Writing in Concrete-Cement Age.

The San Antonio Gas & Electric Company, San Antonio, Tex., has constructed a tank for storing heavy oils, and its superintendent states that after three years' use the tank shows no sign of leakage or deterioration.

Concrete Oil Tanks at Toronto

Four reinforced concrete tanks for the storage of oil were built in the fall of 1910, for the Queen City Oil Company, Toronto, at its West Toronto yards. These were for the storage of the lighter products of petroleum. The inside dimensions for each tank were 21 ft. 6 ins. wide, 38 ft. long and 9 ft. 6 ins. high. They were placed underground and a cover of three feet of earth placed on top of them. The only precautions taken were to obtain a dense concrete and avoid joints and seams. Immediately after stripping the forms, cement grout was applied on the green concrete.

We would suggest a 1:2:4 concrete, made up of 1 bag of cement, 2 cu. ft. of clean, coarse sand, and 4 cu. ft. of well graded, durable crushed stone or gravel varying in size from ¼ in. to 1½ in. The concrete should be mixed with sufficient water to give a wet, quaky consistency. It is not necessary to mix any oil-proof or waterproofing compounds with the concrete, if care is taken to obtain a dense, impervious surface by proper proportioning, mixing and spading of the concrete near the face of the wall. As an extra precaution, the inside of the tank may be brushed with a mixture of cement and water of about the same consistency of cream.

It is very important that the concrete be uninterfered with in its hardening process for a much longer time than is necessary when the concrete is to be subjected merely to water or weather conditions. We recommend that a tank which is to contain oil be allowed to harden from two months to three months before filling with oil, during which time plenty of water should be used to assist the hardening process. The Standard Oil Company is using many concrete tanks for the storage of its oil products, and there is no reason at all why concrete should not be used in the construction of oil tanks, if precaution be taken to allow the concrete to have an unusually long time in which to obtain its full strength before the oil is put into the receptacle.

Oil will not penetrate through a tank of concrete if it is properly constructed and the concrete has been rightly proportioned. Concrete oil tanks are in use extensively throughout Texas and the Southwest. The C. M. & St. P. Ry., the A. T. & S. F. Ry. and the Standard Oil Company all use concrete oil tanks for storage purposes. Reports from the various division engineers of the Santa Fe R. R. Company, regarding the concrete oil tanks on their divisions, show that concrete was entirely satisfactory. The greatest depth to which oil penetrated was 1½ ins.

Pavement Widths and Crowns

By H. I. Fixmer †

As a general policy, the length of road improved is more important than the width. This rule does not often apply to city streets. The determination of proper width of roadway is an extremely important element in design.

A traffic census is often desirable, but unless it is truly comprehensive more can be learned by direct and frequent observation of the street in hand. A traffic census must give not only number and size of vehicles, but the different kinds, kinds and sizes of tyres, wheel loads, rates of speed, space required for storage and parking, and character of adjoining property.

It is customary to allow 8 ft. in width to each line of vehicles, reducing this width as shown in Table I. Where two car tracks are built, not over 10½ ft., centre to centre, a width of 20 ft. is allowed for the free movement of the cars. Table II. shows widths and lengths of typical vehicles found on the streets of Chicago.

Unless the traffic exceeds or promises to exceed from five to ten vehicles a mile moving in either direction, 9 ft. in width should prove ample on our country roads. It is better policy to build a so-called "permanent" road 9 ft. wide (with a 5-ft. earth shoulder on each side) than a poor road 18 ft. wide. In view of the fact that perhaps over ninety per cent. of the time the vehicle occupies the middle of the road, and even in practice on the wider road usually prefers to suffer the slight inconvenience of turning out occasionally in order to ride on the more comfortable or acceptable part of the road, it appears logical to give due weight to this factor of "practical use." If a 9-ft. permanent road is built additions can always be made whenever the traffic warrants it. When consideration is given to the habits and needs of the users of the roads, the soundness of the policy that length of permanent road is more important and desirable than width is soon appreciated.

In city pavements the use of the street for "storage," or rather provision for vehicles to stand alongside or backed up to the curb in front of abutting property, must be considered, and is a vital factor in ascertaining the rational width of roadway.

Thus, in the case of a street having many warehouses, where large trucks back up to the curb to handle goods, we would, after finding that this condition prevails on both sides of the street and that allowance must be made for two lines of moving traffic between the "standing" trucks, determine the roadway to be not less than twice times 8 ft. plus length of truck backed in position. From Table II. this would give 2 (8 + 14) or 44 ft.

In residence districts, where connecting streets are paved as a system, the roadways on all streets where the lots front are made from 24 to 30 feet wide, and side frontage streets from 18 to 24 ft. wide.

Perhaps the most serious condition in securing adequate roadways exists on streets having a double-track car line. Such streets are invariably "business" streets, and require "storage" space for vehicles and automobiles. On such a street, providing for two lines each

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* From a paper entitled "The Design of Pavements," presented at the thirteenth annual meeting of the Illinois Society of Engineers and Surveyors, Springfield, Ill.

† Division Engineer in Charge of Paving, Board of Local Improvements, Chicago, Ill.

TABLE I.

Width of Roadway, ft.	Type of Street Usually Applied to	No. Lines of Vehicles Providing for
9	Average or Light Traffic Road	1
16–78	Side Residence Streets or Double Roadway Streets	2
24	Residence Streets	3
30	Residence and Business Streets	4
38–42	Business and Car Line Streets	5 (Exc. 4 on car line)
48–52	Business and Car Line Streets	7 (Exc. 6 on car line)
60	Business and Car Line Streets and Boulevards	8 (Exc. 6 on car line)

Table II.

Kind of Vehicle	Width, Hub to Hub, ft.	Length, Backed to curb, Front Wheels at Right Angles, ft.
Delivery Wagon	5.5 —6.7	8.7
Single Truck	5.8 —6.0	11.4
Large Truck	6.4 —6.6	12.8—14.0
Newspaper Truck	7.75	14.74
Touring Car	5.5 —5.8	10.0—16.0
Auto Truck	6.7 —*	12.0—?

* Widest truck measured 9.5 feet.

of street railway cars, moving vehicles and "standing" vehicles, we find a width of 2 (8 + 7 + 10) or 50 ft. is required. If the moving traffic is expected to use the car tracks, and the service on the street railway is infrequent, the width may be reduced to 2 (8 + 10) or 36 ft. A roadway width between 38 and 48 ft. in this case would be wasteful.

On a certain main artery in Chicago, where a double car line exists and the roadway is generally but 38 ft. wide, with stores continuously on each side, the unnecessary delay occasioned to the passengers on the street cars by teams and vehicles turning on and off the street railway right-of-way to pass standing vehicles amounts on the average to two minutes per mile travelled. This means that each passenger living an average of five miles from his work loses twice five times two, or twenty minutes, a day. Assuming a low value for his time of 30 cents an hour, the total extra loss to the car users equals the gross receipts of the street railway company! This sum capitalized indicates the sum that might be employed to reduce, or rather remove, the existing street congestion.

A street car that makes good time attracts more people and gives more time to shop, while it distributes business uniformly along the street. For this reason, when a street becomes too congested it becomes necessary to widen the street or place the car line on an elevated structure or in a subway. It is an extremely important question to decide whether it is better to build a subway in a congested business street or use

TABLE III

Kind of Pavement.	Chicago Average Constant "F"	Max. "F"	Min. "F"
Earth	.025		
Gravel	.022		
Macadam	.020	.035	.020
Asphalt	.012	.025	.011
Asphaltic Concrete	.015	.025	.012
Brick	.012	.025	.010
Creosoted Wood	.010	.022	.010
Granite	.015	.025	.010
Concrete	.010	.020	.010

Formula 1.

$C = WF$

where

C = crown, in inches.

W = width of roadway, in feet

F = a constant.

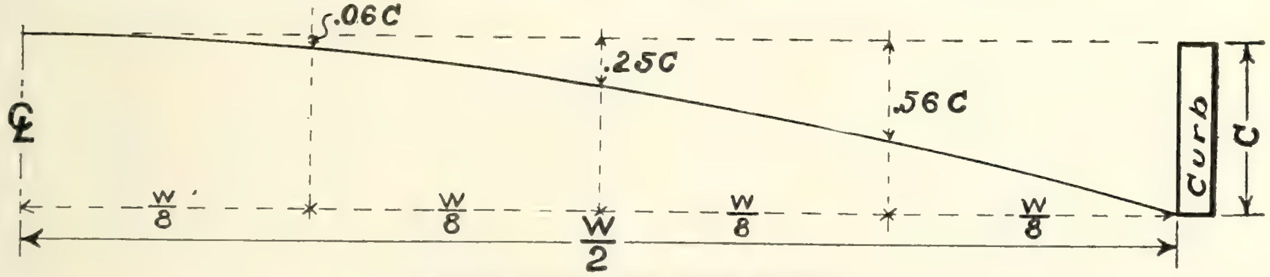

FIGURE 1—PARABOLIC CROSS SECTION.

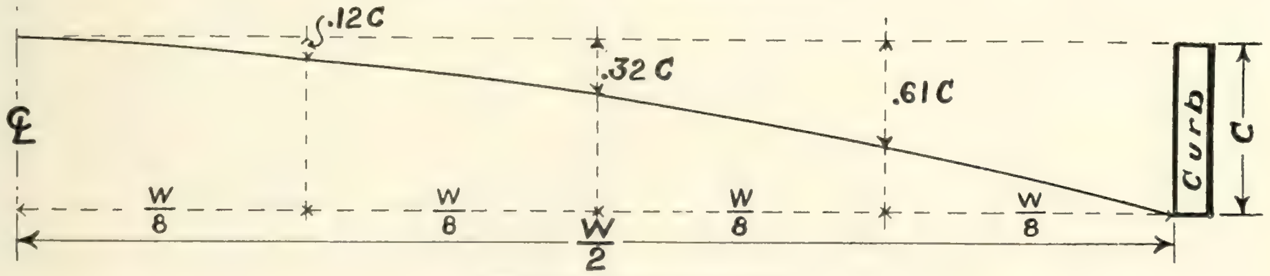

Fig. 2. Compromise cross-section.

The new Knox College, Toronto—St. George Street elevation.

the money to widen the street and keep the car traffic on the street surface in the open air and easily accessible.

The contour of the pavement surface is a matter of more than ordinary importance. For the purpose of drainage the pavement is built with a convex surface; the difference of height of the surface at the centre line and gutter line being called the "crown." Table III. shows the constants employed to determine the crowns of various types of roads and the maximum and minimum values for the constant, as used in Chicago.

As usually built the surface is either an arc or a circle or a parabola. Experience has demonstrated that the parabola form (Fig. 1) is preferable for residence streets, and the "compromise" form (Fig. 2) is more satisfactory on business or "car line" streets, and particularly for pavements having a macadam base.

Country roads can usually be built with a constant crown, since they follow the contour of the natural surface and have sufficient longitudinal grade. If the grade is level the drainage can be taken care of by sloping the grade of the side ditches.

With city streets, which are invariably curbed, if the longitudinal grade is not sufficient to carry off the water, drainage must be provided by "artificial" means. This is done by building sufficient inlets and establishing "summits" in between, whose locations depend upon the grade of street, slope required to drain, and the permissible depths below the curb of the summits and the inlets.

The following formula is given for locating summits (in the gutter):

Formula 2: $$X = \frac{L}{2} - \frac{D}{2R}$$

where

X = Distance of summit from higher inlet;
L = Distance between inlets;
R = Grade of gutter (e. g. 6 ins. fall per 100 ft. = .005);
D = Difference of elevation at inlets (or, usually, the difference in elevation of curb at inlets); all in feet.

On a concrete gutter the assumed value of "R" should not be less than .004. For any block pavement, including alleys, the value for "R" should be not less than .005.

The following formula is given for determining depth of summit and depth of inlet below curb (or grade) to satisfy values in Formula No. 2.

Formula 3: $$J = K + RX + \frac{DX}{L} \text{ or } K = J - RX - \frac{DX}{L}$$

where

J = Depth of inlet below curb (from 8 ins. to 12 ins.);
K = Depth of summit below curb (usually 3 ins.).

The minimum crown from Table III. is used at the summits, and the maximum crown is permitted at the inlets. This reduces the grade along the centre line of the pavement to about one-half the gutter grade, and gives a comfortable surface to travel on.

In shooting to spring holes, tamping them by filling them with water is often preferable to using clay or other material, according to the "PuPont Magazine." Water, however, is not usually anything like as effective a tamping material as sand or clay. Where gravel, tailings or rock dust is used as a tamping material it may be first packed into little bags with economy to prevent cutting fuses and scraping the insulation off battery wires. Misfires often result from this cause. Contractors, however, are generally alive to the advantages of a suitable tamping material, and often buy sand for the purpose, where it cannot be obtained in any other way.

Water Meters in London, Ont., numbered 2562 Jan. 1, 1915, an increase of 486 during the previous year. Only 17 per cent. of services are metered, although 24 per cent. of the water consumed passes through meters and furnishes 40 per cent. of the revenue. Each inhabitant of this town of 56,000 population consumes on the average 81 Imperial gallons per day and the cost of supplying water is $34.15 per 1,000,000 gal.

An Automatic Device which Controls Hypochlorite Application

Apparatus at Institutional Plant Proportions Accurately the Amount of Chemical to Varying Flow of Sewage

An ingenious device for the automatic measurement of the hypochlorite solution used as a disinfecting agent in the sewage treatment plant at the State Hospital for the Insane, Warren, Pa., has been constructed recently and is operating in a very satisfactory manner. The plant, which is described in The Engineering Record by Mr. E. E. Ludwick, was constructed during 1912-13, and treats all the sewage of the hospital group of buildings, having a resident population of approximately 1800. The works comprise a 6500-gal. Imhoff tank, intermittent siphon, sprinkling filter, chemical house, and a final settling tank.

Layout of Chemical House

The chemical house is provided with reinforced-concrete tanks, arranged as shown in Fig. 1. In the north-east corner, at a height of 3½ ft. above the floor, are two dilution tanks, A and B, with a capacity of approximately 660 gals. each, separated by a 4-in. division wall. A mixing trough, C, with a capacity of approximately 100 gals., is supported by this division wall (Fig. 2). A short distance in front of the dilution tanks, and at a height of 2 ft. above the floor, is a measuring box, D, with a capacity of 20 gals., and a little to the side of D, at a height of 6 in. above the floor, is a feed box, E, with a capacity of 22 gals.

The hypochlorite of lime is first dissolved in the mixing trough, C, and then allowed to enter the dilution tanks, A and B, through the outlets shown in Figs. 1 and 2. These outlets are merely holes through the bottom of the mixing trough, which are closed by wooden plugs while the lime is being dissolved. After being diluted to the proper strength the valves in the two 1¼-in. galvanized iron pipes which lead through the front of each tank are opened and the solution flows equally through each to a point where they combine into one 1¼-in. galvanized iron pipe terminating in the measuring box, D. Here a ball float valve (Fig. 3), is located, and, as the two valves mentioned above are left open, this valve controls the flow of the solution from the tanks according to the operation of the automatic device to which it is connected at this point. After flowing through the ball float valve into D, the solution is discharged into E, from which it enters the mixing channel and becomes thoroughly mixed with the effluent from the sprinkling-filter bed.

Automatic Measuring Device

The automatic measuring device, which is operated by the rise and fall of the sewage in the siphon chamber, and which proportions accurately the quantity of chloride solution with the varying flow of the sewage, is connected with the outlet and ball float control valve in D by the method illustrated in Fig. 3. The outlet in D is fitted with a brass ring seat, as shown at a, into and over which fits a brass cap con-

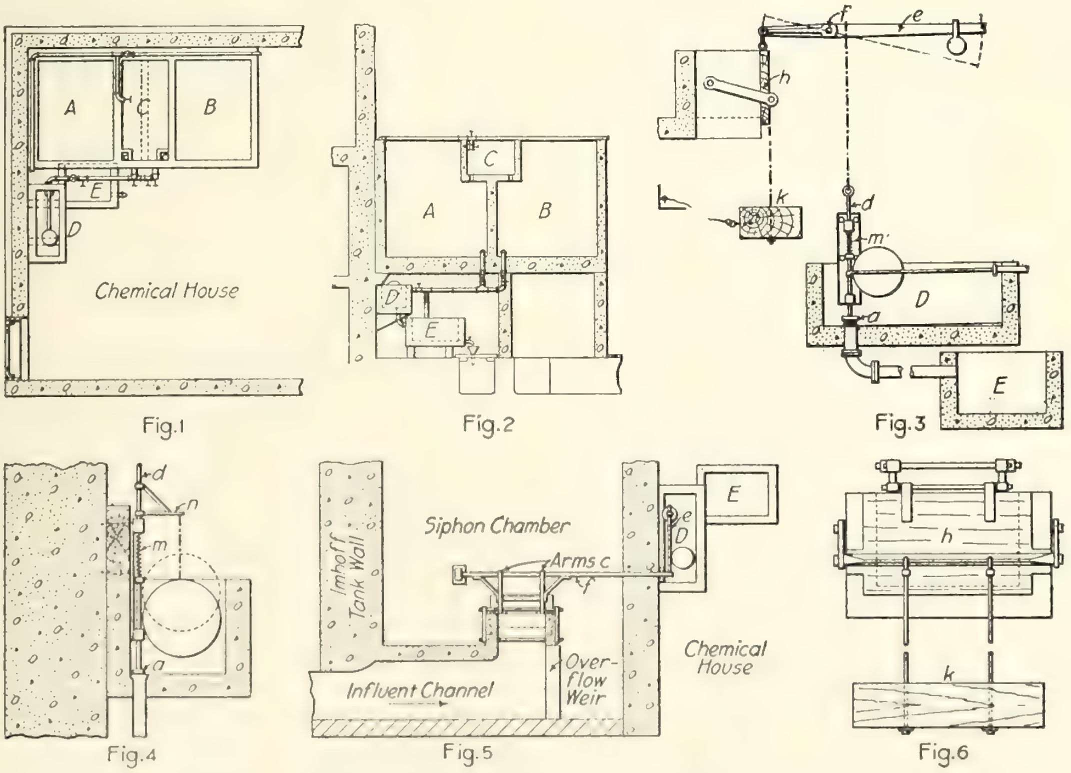

Fig.1 Fig.2 Fig.3 Fig.4 Fig.5 Fig.6

Fig. 1—6. This apparatus proportions chemical application to sewage flow.

nected to a brass rod d, 2 ft. in length. This rod, which is supported in such a manner as to allow a vertical movement, is connected by a chain to a lever e in the loft of the chemical house, which in turn is connected to one end of a revolving horizontal bar f extending through the concrete wall separating the chemical house from the siphon chamber (Figs. 3, 4 and 5). This bar is supported by a concrete pier in the siphon chamber and connected by arms c to a heavy wooden gate, h (Figs. 3 and 6), constructed and supported in such a manner as to give it an oblique movement up and down, when acted upon by the flow of sewage, thereby opening and closing respectively the end of the influent channel (Fig. 5) conveying the effluent from the Imhoff tank into the siphon chamber. It will be noticed that the arms c are on the opposite side of the horizontal bar f from that of the lever e, thus giving them an opposite movement when the bar is rotated. The remaining accessories necessary for the proper operation of this device are a heavy wooden float, k, connected to the wooden gate in the siphon chamber (Figs. 3 and 6), a spiral spring, m, so connected to the brass rod in D as to insure a downward movement (Fig. 4), and a horizontal arm n on this rod to which the arm of the ball float is attached by a chain.

Operating Details

The operation of this device is as follows: We will suppose that the siphon has just discharged the contents of the siphon chamber onto the sprinkling filter—the siphon chamber, therefore, is empty—and the large wooden float now supported by its connections to the wooden gate has, by its weight, pulled the gate down and against the end of the influent channel, thereby closing it. At the same time the lever in the loft of the chemical house has been elevated, thereby lifting the brass rod and cap in D, which opens the outlet at a and allows the contents of hypochlorite of lime solution to flow from D into E, from where it flows into the mixing channel, through which is now flowing the effluent from the sprinkling filter.

At this point of the operation the horizontal arm, n, attached to the rod in D, having been moved up with the upward movement of the rod, now lifts the ball float, by means of the chain connection, and closes the control valve b. As these relative positions are maintained until the rod moves down and closes the outlet in D, it is seen that no lime solution can flow from the dilution tanks into D while its outlet is open.

Ball Float Regulation

The effluent from the Imhoff tank now entering the influent channel cannot flow into the siphon chamber on account of the wooden gate, which, as was stated before, is being held securely against the end of this channel by the weight of the wooden float. It therefore fills the channel until the level of the overflow weir (Fig. 5) is reached. This is merely one side of the channel constructed so as to be 3 ins. less in height than the others. The effluent now overflows into the siphon chamber until in sufficient quantity to raise the wooden float, thus relieving the weight holding the gate in its closed position, and allowing it to be pushed obliquely upward (open) by the head of sewage behind it in the channel. The upward movement of the gate lowers the lever in the chemical house, and allows the rod in D to be forced down by the spiral spring, thereby closing the outlet at a. The ball float has also been allowed to fall, thus opening the control valve b, and allowing the solution to flow into D from the dilution tanks. The solution continues to flow into D until the surface of the same raises the ball float sufficiently to close the control valve, b, and then remains here until the siphon again discharges the contents of the siphon chamber, which releases it as before, the same operation being repeated as described.

Device Used to Measure Sewage in Place of Meter

In the absence of a meter on the force main from the pump house this device is now being used to ascertain the number of gallons of sewage pumped every twenty-four hours. This is accomplished in the following manner: The chloride of lime, after being thoroughly dissolved in C, is diluted in A and B so that in every gallon of solution there is contained 0.0004 gal. of availablechlorine. The intention is to add 1½ parts of available chlorine to every million parts of sewage.

As is seen by the operation of the measuring device just described, each time the siphon discharges the contents of the siphon chamber there is a certain fixed quantity of chloride of lime solution measured and discharged into the sewage. Therefore, as the quantity of sewage discharged by the siphon each time is known to be 1300 gals., in order to add the required amount of available chlorine the arm of the ball float in D has been adjusted so as to close the control valve b when 5.5 gals. of lime solution have flowed into D. Each morning, after the lime has been dissolved and diluted, an accurate measurement of the elevation of the surface of the solution in the dilution tanks is taken and noted, together with the time. On the following morning, at the same time, another measurement is taken, and the amount of solution which has flowed from the tanks in 24 hours computed. This quantity divided by 5.5 will then give the number of times the siphon has discharged, which, multiplied by 1300, will give the number of gallons of sewage discharged or pumped to the plant in 24 hours.

The plant and system entire was designed by C. F. Mebus, of Albright & Mebus, consulting engineers of Philadelphia, and was constructed by P. L. Scholl & Company, of Reading, Pa., under the supervision of Mr. Ludwick, who is now operating the plant for the hospital.

Costs of street repairs in Chicago have been reduced by the municipal asphalt plant. During 1913 asphalt pavements were repaired at a cost of 81.1c. per sq. yd., or 87.1c. per sq. yd. allowing for plant depreciation and interest on investment. At a total cost of $62,637.03 or $1.175 per sq. yd., 53.432 sq. yds. of brick pavements were repaired. Granite block pavements to the extent of 59,345 sq. yds. were repaired at 53.2c. per sq. yd., or a total of $31,593.04. Macadam pavements cost 12.16c. per sq. yd., 1,880,365 sq. yds. having been repaired at a cost of $227,443.03. Of cedar block pavements, 2,595 sq. yds. were repaired at a cost of $524.49, or 20.25c. per square yard.

Scrubbing concrete surfaces with ordinary scrubbing brushes with stiff palmetto or other fibre bristle, with a slight stream of water from a hose or can, will usually be sufficient if the concrete has not set too hard.

Paints Designed to Prevent Electrolysis in Concrete[*]

THE use of a paint as a protective covering for reinforcing steel against damage by electrolysis has often been proposed, but the writer is not aware of any tests having been made to determine a type of coating best adapted for this purpose.

Paints having a high insulating value are generally those drying with a high gloss, which is apt to prevent proper bonding, a fact which has undoubtedly prevented a general use of this protection. A method for overcoming this objectionable feature was developed by these experiments.

Corrosion Causes.—It may be well to review briefly the causes of corrosion in reinforcing steel for the benefit of those not thoroughly familiar with the subject.

The ordinary forms of iron corrosion have been found to be due to auto-electrolysis, the presence of segregated impurities being responsible for differences in potential at certain areas, which set up galvanic action and cause solution and the formation of rust at the positive nodes. A similar but more rapid action takes place when an electric current is passed through an iron anode immersed in an electrolyte, such, for instance, as salt water. When damp cement contains an embedded iron anode the cement acts as an electrolyte, and the same rusting action takes place, regardless of the fact that concrete contains sufficient lime to inhibit corrosion when no electrical currents are present. With the electrolytic change of metal into oxide comes an increase in volume of the products of reaction, and there is developed an enormous expansive force of mechanical pressure, which is sufficient to crack the strongest forms of concrete.

Engineers are active in their endeavors to prevent high voltage currents from running wild, but this fact does not justify a disregard of precautions against stray currents.

Preparation of Specimens and Methods of Testing.—The tests were made on two series of specimens as follows:

1. Rods ½ in. x 12 ins., painted two coats and embedded in concrete cylinders.
2. Rods ¾ in. x 12 ins., embedded as anodes in cylinders of concrete.

All cylinders were 3½ ins. x 8 ins., of cement mortar 1:2. The moulds were removed in 2 days and the cylinders aged for 1 month.

Tests on Series 1 were made by immersing the lower 2 ins. of the specimens in water, connecting them in parallel and passing through them a direct current at 30 v.

Observations were made for 1 week, when small cracks began to show near the bottom on a few specimens.

The specimens were then immersed to within 1 in. of the cylinder tops, the current turned on, and observed for 10 days. Cracking was shown by every cylinder carrying an appreciable amount of current, the fracture starting at the anode.

Wherever the protecting film broke down tre increased passage of current resulted in rapid corrosion of the steel, followed by the expansion and bursting of the concrete cylinder.

Series 2 were tested by placing them in individual earthen jars containing sheet iron cathodes coiled around but not touching the cylinders. The jars were filled witr water to within 1 in. of the top of the concrete.

The cylinders were connected in Series 1 and current passed at 30 v. for 240 hours, when seven specimens developed cracks. The voltage was increased to 55 v., and continued for 60 hours.

Observations on Tests.—In the specimens in which cracking occurred the anodes showed considerable rust, the paint coatings having been broken down. On tre cathodes in Series 1 the paint coatings were still intact, although some had apparently been affected by moisture and the hydrated lime in the wet concrete, chalky surfaces being shown.

The coatings on anode and cathode bars which were embedded in cylinders which did not crack and which carried little current were in a good state of preservation.

Bonding Tests.—In order to determine the comparative bonding strength of rods coated with the various paints a duplicate of Series 2 was made with the exception that the rods were placed flush with the bottom of each cylinder. At 3 weeks the specimens were placed on an iron block drilled with a 1-in. hole and tested in a Riehle[2] testing machine. Some paints that proved to be good insulators failed to show bonding strength, and vice versa. When painting rods in order to overcome the objection to using paints which dry to a gloss surface and prevent proper bonding, these coatings were dusted while tacky (not wet) with sharp particles of sand, which formed a rough surface, assuring a good bond. The corrosion of metal embedded in concrete structures, by stray currents of high voltage, is often productive of serious effects. The use of properly made paints upon such metal constitutes a safeguard that should not be neglected by the engineer. Such paints may be prepared from the following substances:

The vehicle should contain:

Boiled or bodied oils or products which dry to a fairly saturated film.

Oils which dry by semi-polymerization rather than oxidation.

Oils which dry to a flat rather than a highly glossed surface.

The solid portion should contain a percentage of:

Pigments which are coarse and which, therefore, tend to form films having a rough surface.

Pigments which are inert and which do not act as conductors of electricity.

The painted metal should be "sanded," if possible.

The contract for the construction of a plant at Drummondville, P. Q., for the Aetna Explosives Company of Canada, has been let to Westinghouse, Church, Kerr and Company, Montreal. The company, a subsidiary of the American concern, has intimate relations with the Canada Car & Foundry Company, the new plant being erected in connection with the large orders for shells secured from the Russian Government.

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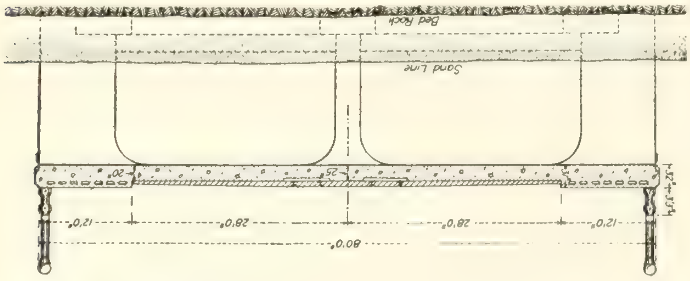
[*] Abstract of paper by Henry A. Gardner, Assistant Director of the Institute of Industrial Research, Washington, D. C.

Flat-Slab Bridges which Combine Permanency and Good Appearance

By Walter H. Wheeler[*]

IMMEDIATELY after the disastrous cloudburst and Cherry Creek flood which occurred at Denver on July 14, 1912, it became necessary for the city, in connectoin with the repair work which followed the flood, to consider the construction of four new bridges spanning the channel of the creek. For most of its course through the city the channel is confined by reinforced-concrete retaining walls and varies from 80 to 100 ft. in width, the depth ranging from 10 to 15 ft. The grade of the creek bed is quite steep, causing the water to flow, in times of flood, at a high speed, and there is frequently considerable debris brought down.

To meet these conditions the city desired to construct bridges which would be as nearly permanent as possible and at the same time be ornamental and provide the greatest area of clear waterway for a given elevation of roadway. It was decided to use reinforced-concrete construction and competitive designs and bids were called for on the Market and Larimer Street bridges, situated on opposite sides of the city hall. Designs were submitted for two-span and single-span bridges of the girder, arch and flat-slab types and contract was let for flat-slab bridges of the "mushroom" type. The design gave a clear waterway 10 per cent. in excess of the other designs submitted. Later the city let a contract for a bridge at Downing Street and for one at Curtis Street, in both of which the same system was specified.



Cross-section, showing main dimensions of one of the bridges.

The new bridges give more clearance underneath than the old steel bridges they replace, and the bottoms of the slabs are smooth and do not offer any opportunity for driftwood to catch in passing under and form a dam, as did the steel bridges.

The Downing Street bridge is 80 ft. wide by 106 ft. long over all. The spans between piers, centre to centre, are 45 ft. longitudinally by 34 ft. transversely. The roadway is 56 ft., with a double-track street-car line in the middle, and 12-ft. sidewalks at each side of the roadway. This bridge crosses somewhat obliquely, so that the longitudinal lines of pier centers intersect the transverse lines of centers at about 70 deg., making the perpendicular distance between longitudinal lines about 32 ft. For purposes of computation the spans will consequently be taken as 45 ft. and 32 ft. The bridge is designed to carry a working live load of 150 lb. per square foot over the full area and provides for a moving load of one 75-ton car and one 18-ton road roller on each panel, plus ordinary vehicle and foot traffic. The rails of the car tracks are carried on Carnegie 5½-in. steel ties embedded in the concrete of the slab. The roadway is paved with 3½-in. 16-lb. creosoted wood blocks, manufacturers' standard specification, laid on a 1-in. sand cushion. The slab is 20 in. thick at the gutter, 25 in. thick at center of roadway, 31 in. at inside edge of sidewalk, and 32 in. at outside edge of sidewalk. There are three rows of three columns or piers each crossing the stream, a middle column of each row in midstream. The center midstream pier is 36 in. square; the two outside midstream piers are built oblong in section and are 3 ft. wide by 9 ft. 6 in. long, the idea being to bring the piers out flush with edge of the bridge and give the spans, when viewed from the side, the appearance of a flat arch. The six end piers are 42 in. square.

All piers are carried down to bedrock and anchored thereon with four 1⅜-in. round rods extending 4 ft. into the rock and grouted. Bedrock at Downing Street averaged about 5 ft. below the Creek bed, at Market Street about 15 ft. The bedrock is shale and the footings of the piers are proportioned for a bearing on the rock of about 8 tons per square foot when the bridge is fully loaded. Embedded in each sidewalk 24 in. above the bottom of the slab are 7 lines of 4 x 12-in. hollow tile, spaced 18 in. on centers, for wire conduits. At each end of the bridge a thin wall is carried down flush with the edge of the bridge to the top of the retaining wall to carry out the flat-arch effect.

Reinforcing

The reinforcing in the slab consists of belts of rods running in four directions, between piers, with 16-ft. laps in every belt at each mushroom head. The belts are 16 ft. in width, which is the width of the "mushroom" heads on the piers. These heads are made exceptionally stiff, having twice the usual number of radial and ring rods. The outer edges of the slab are carried as a cantilever and reinforced with supplementary rods running longitudinally near the edges of the slab. There is also supplementary reinforcing in the sidewalk near the surface. The columns or piers are reinforced with vertical rods and spiral hooping. All steel is plain round bars, manufacturers' standard specifications for structural grade.

The wearing surface of the sidewalks is floated smooth and blocked off in squares. The hand railing and lamp posts are of ornamental cast stone manufactured by the National Stone Manufacturing Company of Minneapolis, and are laid up in cement mortar.

The writer is not aware that any tests have been made on the bridge since its completion, but it has been in actual service about two years. The construction work was done during the winter with the thermometer registering as low as 20 deg, below zero at times. Artificial means were employed to prevent the concrete from freezing. The water used in mixing, as also the aggregate, was warmed, and salamanders were kept fired under the slab for a period of about three weeks after casting.

Referring to Dr. Henry T. Eddy's book, recently published, entitled "The Theory of the Flexure and Strength of Rectangular Flat Plates, Applied to Reinforced-Concrete Floor Slabs," and applying his formula, it will be noted that the width of the belts of rods in the slab of the Downing Street Bridge should be such in the mushroom system as to make them cover practically the entire area of the slab, which is found to be the case in this design, although, by reason of the obliquity of the bridge, this width is some 10 in. less than $7\ (L_1 + L_2)/32$, which would have been required in case of rectangular panels for the "mushroom" system, where L_1 equals longitudinal span and L_2 transverse span. Applying his formula and assuming a deed load for the slab of 350 lb. per square foot and a live load of 150 lb. per square foot distributed over the full area of one panel, which equals a total load of 720,000 lb. evenly distributed, we find f_s, the stress on the steel, is about 8300 lb. per square inch, and under a test load of double the working load f_s equals about 10,800 lb. per square inch at the middle of the 45-ft. span.

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[*] With C. A. P. Turner, Consulting Structural Engineer, Minneapolis.

The number and length of the laps over the columns reduce the unit stresses in the steel over the edge of the caps below that at midspan. Were four times the live load placed upon the bridge, the greatest unit stress in the steel would be only 15,800 lb. The factor of safety may, consequently, be taken as more than 4.

Again applying his formula for the deflection at the center of the panel, we find, under a test load of 300 lb. per square foot evenly distributed over the full area of a panel, the deflection at the center would not exceed 0.18 in., which is less than 1/3000 of the span. But this formula is one derived to compute actual deflections for heavy loads only where the unit stresses in the steel are 20,000 lb. or more, and give results much in excess for small loads. On this account and owing to stiff sidewalks over 30 in. deep, longitudinal car rails, and pavement, it is probable that no deflection could be detected under test load.

Assuming the neutral axis to be at the bottom of the slab at the edge of the pier the maximum stress on the concrete on the center of theslab, computations show that caps is everywhere less than 700 lb per square inch, the allowable working stress.

From the above it will be seen the stress values for concrete and steel used in designing the slab of this bridge are very conservative. It will also be noted that the formulae used in obtaining the above values for stress in steel and concrete are applicable only where the stiff column heads of the "mushroom" system are used.

The Downing Street bridge was constructed by the C. P. Allen Contracting Company of Denver. The concrete for all piers was cast up to sand line before the centering for the slab and the remainder of the piers were erected. The balance of the bridge was cast in one operation, but not continuous, the slab being divided into panels, so that one panel with its piers could be completed in a day's run, all joints in the slab being made at the centers ofspans, using temporary wooden bulkheads to secure smooth vertical joints. The concrete was all machine mixed and placed with two-wheeled carts.

Centering

The centering for the slabs consisted of 6 x 12-in. posts spaced about 8 ft. 3 in. on centers both ways, carried on 12 x 14-in. mud sills and sway-braced both ways with 3 x 6-in. bracing. Stringers 12 x 12 in., of Oregon pine, were laid directly on the posts, and 2 x 12-in. Oregon pine joists laid over the stringers 12 in. on centers, with 1-in. sheeting over the joists. Very little cutting of the form lumber was necessary because of the flat slab without beams, and the salvage on it to the contractor was therefore exceptionally large.

Mud sills were used instead of piling, as ordinarily Cherry Creek carried very little water in the winter time, and it was expected the work would be completed before the usual spring freshets. The specifications provided that the slab centering should remain in place for not less than sixty days. The work was delayed somewhat in starting, which brought the casting of the slab later in the spring than was expected, and about thirty days after casting an unusually early freshet cut away the sand under the mud sills, allowing the forms to settle several inches. As far as could be observed, however, there was no settlement in the slab. This practical test clearly shows that the concrete when properly cured is far from overstressed, as it is now probably three times as strong in compression as it was thirty days after casting, and should carry five times the full working live load as easily as it then carried its own dead load.

The contract price for the bridge, plus the cost to the city of reinforcing diagrams, steel and artificial stone, was about $17,400. This did not include the track work, which was a separate item and paid for by the Denver City Tramway Company. As the bridge is constructed it is absolutely independent of any end abutments or retaining walls, and approaches and retaining walls, could be entirely washed away and the bed of the creed scoured down to bedrock without injury to the bridge. In the event of a flood passing over the top railing and lamp standards might be injured, but could be easily and comparatively cheaply replaced. The stone railings might wash away if submerged by a flood and leave only the relatively thin slab impeding the flow of the water, which would tend to cause only slight overflow. The weight of the bridge itself adds greatly to its permanency.

The total contract price for the Market Street bridge was $17,150; for Larimer Street bridge $17,850. The contract price of the Curtis Street bridge plus cost to city of reinforcing diagrams, steel and artificial stone was $12,300. On all four bridges the writer acted as engineering agent for C. A. P. Turner of Minneapolis, designing and furnishing the reinforcing steel and artificial stone.—Engineering Record.

A draft of a new ordinance to govern fireproof construction of buildings in New York City, prepared by a committee of the Board of Aldermen, with Mr. R. P. Miller as expert, contains the following rule for determining the safe carrying capacities of concrete-slab floors: "The gross load in pounds per square foot of floor space shall not exceed the product of the depth in inches of the reinforcement below the top of the slab, by the cross-sectional area in square inches per foot of width of the tensional steel, divided by the square of the span in feet, all multiplied by the following coefficients: When cinder concrete is used 14,000 if the reinforcement is not continuous over the support, 18,000 if the reinforcement consists of rods or other shapes securely hooked over or attached to the supports, and 26,000 if the reinforcement consists of steel fabric continuous over the supports; and when stone concrete is used, 30,000 and 40,000 respectively." The rule is a portion of a revision of the city's building code, now in progress.

Depositing Concrete Under Water

CONCRETE is deposited under water in several ways, such as in paper bags or open cloth bags, through pipe tremie and by boxes properly built to dump concrete after being lowered to bottom. Very commonly it is deposited by means of concrete buckets with trip-line arrangement whereby the catch on the bottom of the bucket is released and the concrete flows out when the bucket is raised. It may be said in general that on each job some one method is the best. The proper method may be determined by physical conditions, by the size of the job, or by some other condition. For example, where concrete is to be placed about a cluster of piles which are close spaced, in such case there will be loss of time in lowering the bucket so as to miss the piles, or the piles may be too closely spaced to allow an ordinary sized bucket to be lowered between them, making a special size bucket necessary if it is to be used. Where it is considered essential that the concrete clutch the piling I would hardly care to risk the paper or cloth sacks. In the above example a pipe tremie would be best. Consider the job which is too small to warrant much equipment. In such case, it might be best to use the cloth or paper sacks filled with concrete as this could be done with little outlay. If for some reason it is not desirable to use them, then a tremie may be rigged up at comparatively small cost.

Attaching Machinery or Piping to Concrete Floors

THE following is an extract from an address by Mr. Leonard C. Wason (President Aberthaw Construction Company, Boston) delivered before the National Association of Cotton Manufacturers:

It is an easy matter either to embed insets in the floor for attaching shafting, piping, etc., in a pre-arranged method, or to insert these so that timbers can be bolted to them and allow an elastic method of attachment. Again, it is fairly simple to drill holes for the insertion of expansion bolts, where no previous provision has been made. The cost of setting these inserts varies with their style, but for material and labor may be said to run between five cents and ten cents each. They can be attached as readily to corrugated iron, which is to-day very extensively used for form work, as to the wooden panels which were used most extensively some years back. Corrugated iron is much cheaper to use for form work than wood panels, and the writer thinks it makes a much better looking ceiling.

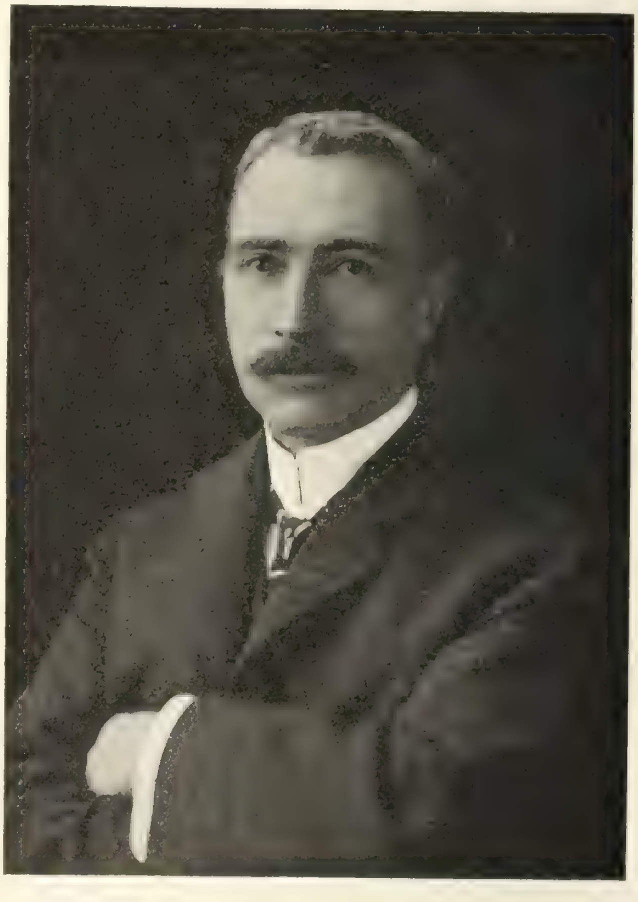
The following short list gives, according to a Pittsburgh newspaper, the total number of church edifices built in the United States area during the seventeenth century which have escaped the destroying hand of time, and the more destructive neglect and indifferent attitude of man: St. Luke's, Smithfield, Va., 1632, a brick building, of which Joseph Bridger was the architect; the Ship Meeting House, so called because it was built of ships' timbers, at Hingham, Mass., 1681; the Quaker Meeting House at Flushing, 1692; "Gloria Dei," Swedish, Philadelphia, 1697; Trinity, Wilmington, Del., and the Dutch Reformed Church at Oakland, N.J., both built of stone in 1698.

Personal Mention

Mr. James Ballantyne, ex-President of the Montreal Builders' Exchange, and Mayor of Montreal West, has been made a Justice of the Peace for the District of Montreal.

Mr. Malcolm H. MacLeod

Mr. Malcolm H. MacLeod, of Winnipeg, to whom we have pleasure in introducing our readers, is General Manager and Chief Engineer of the Canadian Northern Railway. He was born at the Isle of Skye, in the County of Inverness, Scotland, fifty-eight years ago, and came to Canada as a child. He has been engaged in the location and construction of various railways since 1878, and is considered one of the best informed railway men on the continent. Prior to making connections with the C. N. R., he was Chief Engineer in the Crow's Nest Division and later superintendent of operations in the same district for the Canadian Pacific Railway. He left the service of the C. P. R. to accept the appointment of Chief Engineer for the Canadian Northern Railway. This was in 1900. He was appointed to his present office as General Manager and Chief Engineer in 1907. A few years ago, upon the occasion of the visit of H. R. H. Prince Arthur of Connaught, Mr. MacLeod was presented by the Prince with a handsome testimonial as a mark of recognition of the genius behind the C. N. R. system.



Mr. Malcolm MacLeod, of Winnipeg, General Manager and Chief Engineer of the Canadian Northern Railway

Mr. A. J. Matheson, of the firm of Cartwright, Matheson & Company, consulting engineers, Vancouver, left the West recently for the Federal Capital. Mr. Matheson has been appointed a member of the Commission recently named by the Dominion Government to investigate the water levels in Montreal Harbour. The Commission will begin work at once, and the investigation will take about two years. The members of the Commission are Mr. W. J. Stewart, of Ottawa, Chief Hydrographer for the Dominion; Dean Haskell, of McGill University, and Mr. F. W. Cowie, Engineer for the Montreal Harbour Commission. An inquiry will be made into all the factors affecting the water levels at Montreal, such as the inflow from the Ottawa River, the power dams at Cedar Rapids, Cornwall, Coteau, etc., and the Chicago drainage canal. Methods to prevent the annual ice jams in the St. Lawrence channel will also be studied.

Mr. H. B. VanEvery has been appointed Canadian representative of the S. Morgan Smith Company, of York, Pa., manufacturers of hydraulic turbines and accessories. His office is in the Power Building, Montreal.

A number of prominent contractors were in Toronto last week for the purpose, it is reported, of conferring with the directors of the Canadian Northern Railway. The visitors included Mr. P. Welch, of Spokane, Mr. J. A. Stewart, of Vancouver, and Mr. T. W. Horne, of Fort William.

Mr. J. R. MacLeod, who has done excellent work for the city of Montreal, as tramways and railways engineer, has been appointed head of the Sewers Department, in succession to Major Stuart Howard, retired on a pension. Mr. MacLeod will combine the two offices. Mr. Alex. Martin has been made Assistant Chief Engineer to Mr. Mercier, Acting Chief Engineer. Mr. G. Janin, the head of the engineering department, is at present on active service in France.

Mr. Joseph R. Henderson of Montreal, President and General Manager of Brandram-Henderson, Limited, died suddenly at Halifax on July 31st. Mr. Henderson was a native of Hexham, Northumberland, Eng., and came to Canade when eighteen years of age. After three years of farming, he entered the service of an Ontario firm of paint and oil manufacturers. From that time on he was engaged in that line of business, eventually forming the present company in conjunction with Brandram Bros. and Company of London, Eng.

Col. Cantley, President and General Manager of the Nova Scotia Steel and Coal Company, states that the shipping of the two thousand cars which the company are now manufacturing for the Russian Government will begin next month. All arrangements for the transport of the cars to Vladivostok have been completed. The iron and steel plants of the company at Sydney and New Glasgow are now running at full capacity, and Col. Cantley says the payroll at the present time is the largest in the history of the company, $59,000 having been paid out in wages during the last fortnight, which is at the rate of $4,000 a day. When the order for the Russian Government is filled, the company will begin the manufacture of one thousand cars for France. Negotiations for further war orders are under way.

Mr. R. T. Stull, E. M. Cer., has become associated with the Dunn Wire-Cut-Lug Brick Company, of Conneaut, Ohio, as its ceramic engineer. His special duty will be to advise with the licensees of the Dunn Company, and help them with their brick-making problems. Mr. Stull is widely known as the author of numerous contributions to ceramic literature, as well as in practical and educational fields. He is a graduate of the Department of Ceramic Engineering at Ohio State University, and for five years was connected with various important ceramic industries as superintendent. He became Instructor in Ceramics in the University of Illinois, in 1907, and has been connected with that institution continuously since that time. In August, 1913, he was advanced to position of Acting Director of the Department of Ceramic Engineering. He is a member and Vice-President of the American Ceramic Society, a member of the American Chemical Society, American Society for Testing Materials, National Brick Manufacturers' Association, and the Illinois Clay Manufacturers' Association. He is also a member of the Honorary Scientific Society of Sigma Xi, Alpha Chi Sigma, and Keramos. In engaging the services of Mr. Stull the Dunn Wire-Cut-Lug Brick Company was influenced by a desire to give its licensees the benefit of the highest scientific assistance in perfecting the quality of their brick. This is an extension of the policy of the company as already developed in the maintenance of a corps of expert engineers who are supervising the constructional work.

Mr. A. R. Decary

Mr. A. R. Decary, consulting engineer and architect, Quebec, P. Q., is well known as the superintending engineer for the Provincial Department of Public Works. He was born at Montreal in 1875 and was educated at Laval University, beginning practice in Montreal. He was appointed Engineer in the Department of Public Works in 1899 and was nominated a few years later District Engineer of the same department. He became Superintending Engineer for the province two years ago. Mr. Decary is a member of the Canadian Society of Civil Engineers and is a past president of the Quebec Branch of that body. He is a Fellow of the Royal Architectural Institute of Canada and is a member of the Province of Quebec Association of Architects and also of the Quebec Geographical Society. In these times it is of interest to note that he entered the Army Service Corps in 1906 and was transferred the following year to the Corps of Guides as Special Service Officer.

Mr. A. R. Decary, F.R.A.I.C., Quebec, P.Q.

The Contract Record would like to get in touch with a thoroughly competent building and contracting superintendent capable of showing efficiency in the handling of a $100,000 or $150,000 contract, buying supplies, controlling labour, and so on. The inquiry is from Ottawa.

Mainly Constructional

East and West—From Coast to Coast

Ninety-three permits issued last month in Winnipeg represented an expenditure of some $200,000.

A London, Ont., firm, John Hayman & Sons, are the contractors for the $30,000 addition to the Ingersoll factory of the Borden Milk Company. We are informed that operations are to be started forthwith.

The Phoenix Bridge and Iron Works, Limited, are to be congratulated on securing the contract for the $200,000 extension to the Harrison Bakery at Westmount. The new building is to be three storeys high, 265 x 140 feet in dimensions, of brick and steel construction.

Good progress is being made on the new building which is being erected on University Avenue, Toronto, for the Provincial Hydro-Electric Commission. At present the walls are about finished. The new building is to be six storeys high, with basement, and the construction is to be of steel, terra-cotta, and brick. The estimated cost is $200,000. Messrs. Witchall & Son are the general contractors.

If the local "Herald" can be termed an authority, the building trades at Stratford, Ont., are brisk, in spite of the war. Among the larger buildings now under construction are the Diebel Furniture Factory, the Bartlett Automobile Factory, a garage for McDonald & Henry, and a considerable amount of residential work. Local contractors are reported to be optimistic about the amount of work that will yet be done before the snow flies.

Plans for a sewerage scheme for the town of Chambly Basin, P. Q., have been prepared by Mr. J. A. Gravel, of Montreal. It is proposed to construct 34,000 feet of sewers, and to pump the sewage by means of two electrical pumps of a total daily capacity of a million gallons into the Richelieu River, the pumps being operated by current supplied by the Montreal Light, Heat, and Power Company. The sewage will be carried from the pumping station by means of steel pipes which run 700 feet into the river. The town is also to construct 80,000 square yards of cement sidewalk.

The Banque Nationale, of Quebec City, have decided to rebuild their premises, and on the instructions of the directors, the plans have been drawn up by Mr. Emile Tanguay. The building, on St. Peter Street, will be six storeys high, and will be 120 feet above the level of the ground, the site being 60 x 66. The basement and first storey will be constructed of granite, and the remainder of Deschambault stone, with a steel frame. The Bank will occupy the lower portion of the building, five storeys being utilised for general offices. The plans provide for dining rooms for employees.

In British Columbia gangs of approximately one thousand one hundred men are now engaged in putting the finishing touches to the C. N. R. line. It is predicted that so far as the track is concerned the company will be in a position to run trains over its entire system from the Atlantic to the Pacific by October 7th. Construction work is proceeding apace on the station buildings, roundhouses, water-tanks, and other structures. Traffic on the section of the line from Port Mann to Hope, on which a tri-weekly service is being operated, is showing satisfactory results. A number of small industries are opening up at points along the line, and the indications are that the business will exceed expectations.

The contract for asphalt has given the city of Montreal considerable trouble this season. The first contract was stopped by the Court, on the ground that the Controllers exceeded their authority, and it was then decided to call for fresh bids. Two offers were seriously considered, that of the Aztec Oil and Refining Company at $15.50 per ton, and that of the Warner-Quinlan Asphalt Company at $14.25 per ton. It was proposed to divide the contract, but this was objected to; and in the course of discussion, it was asserted that the Aztec Company would take legal proceedings if the tender of the opponents were accepted, on the ground that all the conditions had not been fulfilled. The Controllers, however, decided to accept the bid of the Warner-Quinlan Company, that being the lowest, after the analysts and Mr. P. Mercier, the Acting Chief Engineer, had recommended to that effect.

A decision just rendered by the Railway Commission is of interest to municipalities and to those concerned with the Good Roads movement. Application had been made to the Board requesting it to order that low commodity rates should be extended by the railway companies for the transportation of gravel so as to enable the municipalities of Western Ontario to proceed with the work of general road improvement at a reasonable expense. The Chief Commissioner, after hearing the evidence, makes the announcement that the railways will carry in the territory in question gravel required by the municipalities at a flat blanket rate of fifty cents a ton for any distance up to and including fifty miles. The concession is made in the light of public policy, and the possibility of increased railway business as a result of the added prosperity, and with the understanding that the rates offered are not to be regarded as indicating sufficient rates for similar commercial service.

Bulletin 108 of the Lackawanna Steel Company (H. A. Drury Company, Limited, Montreal, general agents for Canada) describes fully and illustrates clearly and attractively the arched-web, straight-web, centre-flange, protected and plate types of steel sheet piling, which have been developed theoretically under the direction of the inventors and an able engineering staff, and have been brought to a high state of mechanical efficiency in mills which have long enjoyed an enviable reputation for the quality of their entire output. The Lackawanna Steel Company maintain a Steel Sheet Piling Engineering Department to furnish reports, suggestions, and tentative plans to assist in the correct and economical use of their product in the many forms of construction for which it is adapted. The catalogue is illustrated by many excellent half-tones and diagrams, and not only the contractor, but the engineer, will find in it much that is interesting and informative.

"Lumina" solid steel windows, doors, and partitions are described in an attractive illustrated catalogue issued by the Detroit Steel Products Company, Detroit, Mich. These windows are claimed to give the maximum amount of natural light, and to have many advantages, both from a mechanical standpoint and from that of investment. Perhaps the outstanding advantages may be stated to be maximum daylight, perfect ventilation, simplicity, and low cost. "Lumina" solid steel windows are installed in scores of the most modern factories on the continent, and among others in the following Canadian plants: B. C. Electric Railroad Company, Vancouver; Detroit-Windsor Ferry Company, warehouse, Windsor, Ont.; Edison Illuminating Company, Sandwich, Ont.; Ford Motor Company of Canada, Service Station, Montreal; Ideal Concrete Machinery Company, Windsor, Ont.; Michigan Central Railroad Company, St. Thomas, Ont.; National Wire and Spring Company, Windsor, Ont.; Stearns Laundry, Windsor, Ont.; Sydney Stephenson, Planet Building, Chatham, Ont.; Arcadia Coal Company, Silverton, N. S.; and Chicoutimi Water and Electric Light Company, Pt. Arnold, Que.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Belleville, Ont.

Granolithic walks have been authorized along West Coleman, East Chatham, Howard, and a portion of Moodie, Boswell and West Bridge Streets. City Engineer, J. W. Evans; Clerk, J. W. Holmes.

Calgary, Alta.

The projected paving on Seventeenth Avenue has been turned over by the City Council to Commissioner Garden and City Engineer George W. Craig to report. City Clerk, J. M. Miller.

Hamilton, Ont.

Work is to start at once on the asphalt pavement to be laid along Spruceside Avenue by the Board of Control at a cost of $4,887. Material required will be purchased by A. Kappelle, Secretary of Works Department. Clerk of Board of Control, S. H. Kent. Engineer, A. F. Macallum. Day labor.

Listowel, Ont.

A by-law is to be submitted by the Town Council for the installation of a water-works system to cost $5,400. Mayor, A. W. Featherstone. Town Clerk, William Bright. Vote will be taken on August 21st.

Matheson, Ont.

The rate-payers have approved a by-law to secure a water supply from White Fish Lake at a cost of $20,000. Town Clerk, E. B. Sanders; engineers, McAustan & Anderson, North Bay.

Meaford, Ont.

A by-law for street improvements is to be submitted by the Town Council. Estimated cost, $10,000. Town Clerk, C. G. Albery.

Millardville, B. C.

Tenders are to be called soon by the Municipal Council of Coquitlam for the supply of material for water installation, the work to be done by day labor, under Constructing Engineer F. L. Macpherson. The Municipal Engineer is Engineer Burnaby, and the Reeve is Mr. Marmont.

Minto Township, Ont.

Tenders are open and will be received by the Township Clerk until noon, August 16th, for the construction of municipal drain No. 6, length 16,000 ft., containing approximately 12,500 cubic yards of excavation. Plans and specifications at the office of the Clerk.

Montreal, Que.

Tenders will be received by the City Council (Secretary, L. N. Senecal) until August 12 for the supply and delivery of paving blocks. Specifications at office of Superintendent of Purchases and Sales, City Hall.

North Grimsby, Ont.

Grimsby Village and North Grimsby Township are having plans prepared for the installation of a water-works system at a cost of some $5,600. For particulars address E. Bromley, Clerk, Grimsby P. O.

North Vancouver, B. C.

The Board of Works has recommended that Robson and Keith Roads be repaired from Berwicke to McKay, to connect with Marine Drive in West Vancouver. Clerk, J. Cowlins; Engineer, A. M. West.

Ottawa, Ont.

Work is about to be started by the City Council on the construction of a sewer along Carruthers and other streets at a cost of $9,769, the length to be 1,400 lin. ft. and the work to be done by day labor. Mayor, N. D. Porter; City Engineer, F. G. Askwith.

Paris, Ont.

A by-law to raise $4,000 for various purposes, including the construction of a concrete bridge on William Street, and the purchase of gravel pits, is to be submitted to the rate-payers. Clerk, Thos. McCosh.

Peterboro, Ont.

Tenders are open for castings, and will be received by the City Engineer until August 11th, for period up to March, 1916. Engineer, R. H. Parsons; Clerk, S. R. Armstrong.

Rossland, B. C.

The City Council contemplates the construction of a sewerage system along First Avenue, between St. Paul and Monte Christo Streets. The matter was referred to committee for report at next Council meeting.

Simcoe, Ont.

Plans have been drawn for two sewage disposal beds, 100 x 200. Submitted to the Provincial Health Department for approval. Mayor, W. Williamson. Town Clerk, W. C. McCall.

Stratford, Ont.

The public Utilities Commission have approved the laying of 1800 feet of 6-in. water-main and 300 feet of 2-in. mains to the Agricultural Park.

Sudbury, Ont.

Sewer extensions, etc., have been authorized, along Elm, Cedar and Larch Streets. Town Clerk, W. J. Ross.

A by-law authorizing granolythic pavements on certain streets has been passed. Town Clerk, W. J. Ross.

Toronto, Ont.

The City Council will pass on a by-law on August 23rd having for its object the widening of Lansdowne Avenue. The amount of the proposed expenditure has not yet been made public. R. C. Harris, Commissioner of Public Works.

The Commissioner of Works (R. C. Harris) has presented to the Board of Control a report in connection with the Morley Avenue sewage disposal system. The recommendations call for the installation of Imhoff tanks at a cost of $6,000,000, sprinklers costing $3,287,000.

York County, Ont.

Work is to be commenced at an early date on road improvements promoted by the County Council (Clerk, R. W. Phillips, 57 Adelaide Street E., Toronto; Engineer, F. Barber, same address). Improvements to be undertaken are as follows: Yonge Street from Richmond Hill to Holland Landing; Eagle Street into Newmarket, continuing through Queensville, Sharon, Keswick, Bellhaven and Sutton to Pefferlaw, West York Ninth Concession of Schomburg.

CONTRACTS AWARDED

Broadview, Sask.

The waterproofing contract in connection with the building of the concrete subway for the Canadian Pacific Railway has been awarded to the Canadian Asphalt Company, of Winnipeg.

Brockville, Ont.

The City Council has awarded the contract of $4,600 for the intake pipe to the Donnelly Wrecking Company, Ogdensburg, N. Y. The work will consist of laying 800 ft. of intake pipe out into the river. City Engineer, Geo. Bryson, Victoria Hall; City Clerk, Geo. H. Dewey.

Chambly Basin, Que.

The Municipal Council (Engineer, J. A. Gravel) have awarded to S. W. Hamilton, of Montreal, the contract for sewer and steel pipe and pumps.

Fraserville, Que.

The contract for the concrete reservoir has been awarded by the Town Council to John Martin, Fraserville, at $8 per cu. yd. Town Clerk, Mr. E. Talbot.

Lancaster Parish and St. John, N. B.

The contract for excavation, refilling of trenches and building of sewers, at a cost of $5,000, has been awarded by the Sewerage Board to Kane & King, 93 Prince William Street, St. John, N. B. Chairman of the Board, W. H. Golding, Fairville, N. B.; Secretary, J. K. Kelly, Prince William Street, St. John, N. B.

Montreal, Que.

The City Council have awarded a contract for 5,000 tons of asphalt to the Warner Quinlan Asphalt Company, of this city.

Niagara Falls, Ont.

The contract for the construction of a vitrified brick pavement on Queen St. has been awarded to C. H. Kumeyer, of this city, at $9,244. The City Clerk of Niagara Falls is Mr. W. J. Seymour, and the City Engineer Mr. F. J. Anderson.

P. A. Lorenzo has obtained the contract for reinforced concrete paving on Robert Street, at $4,215.

St. John, N.B.

The contract for the 6-in., 8-in., 10-in.

and 24 in. cast iron pipe, at $33 per ton, has been awarded to Vroom & Arnold, Bank B. N. A. Building. Engineer, William Murdock.

Toronto, Ont.

The Board of Control has awarded the contract for the Queen Street and Kingswood sewer to McLaren & Company, Barrington Avenue, and for the Jones and Boultbee Avenue Sewer to Commissioner of Works, R. C. Harris, City Hall.

Railroads, Bridges and Wharves

Arden, Man. (over White Mud River)

Work is to be started at once by the Municipality of Lansdowne on the reinforced concrete bridge, at a cost of $5,600, 1 span, 90 ft. over all, the roadway to be 18 ft. The general contractor is Alex. Scobie, care Secretary-Treasurer, M. E. Boughton, Arden.

Canwood, Sask.

Work is to be started soon, under a Board of Directors, on the erection of an elevator. The Board is composed of the following: A. Mcowan, President; A. Hawkesworth, Secretary - Treasurer; Messrs. Wahl, Quellette and Gordon, Directors.

Notawasaga Twp., Ont.

Work has been started on the $3,000 bridge for the Simcoe Council by McDougall & Tool, general contractors, Midland, Ont. The County Clerk is R. J. Fletcher, Barrie, Ont.

Puttown, Ont. (near River Nith)

New tenders are being called by Brant and Oxford Counties for the $7,000 Bridge, 1 span, 150 ft. long, 16 ft. wide, steel and reinforced concrete construction. Tenders will be received by the Clerk of Brant County, A. E. Watts, K. C., Brantford, until noon, August 14th. The specifications and plans are with the engineers, Jackson & Company, Temple Building, Brantford.

St. John, N. B.

Tenders are open and will be received by the Provincial Government Department of Public Works until noon, August 18th, for the dismantling of the old suspension bridge at St. John, N. B. Minister, John Morrissy, Fredericton. Specifications at Public Works Department, Fredericton, Provincial Government Rooms, St. John, N. B., and Structural Engineering Company, Limited, 503 New Birks Building, Montreal.

CONTRACTS AWARDED

Province of New Brunswick

The contract for the bridge at Moosehorn Brookmouth has been awarded by the Provincial Government Department of Public Works to E. Smye, Norton, Kings County, N. B.

Public Buildings, Churches and Schools

Aroostook Junction, N.B.

In connection with the four-roomed brick school which is being erected here at a cost of $7,000, the architect and general contractor, S. L. Steeves, Woodstock, N. B., will purchase building materials and also school equipment, desks, etc.

Cochrane, Ont.

The walls of one storey of the new $40,000 school are up. The contractor is W. G. Hunt, Box 408, Cochrane, who is putting up the school for the School Board, of which W. D. McDouglas is Secretary. The architects are Angus & Angus, McCool Building, North Bay. Sub-contracts are let as follows: heating and plumbing, Taylor Hardware Company; wiring, Ward and Ainsworth, Cochrane.

The foundations are laid for the Town Hall and jail building, the estimated cost of which is $4,000. Van Rassel Bros., Cochrane, are the general contractors, the plumbing and heating being carried out by C. S. Giles, Cochrane, and the wiring by Ward & Ainsworth, Cochrane. Town Clerk, H. J. Brown.

The foundations are in for the hospital under construction for the Cochrane General Hospital by Van Rassel Bros., Cochrane. The estimated cost of the building is $7,222.50. Plumbing and heating is being carried out by Farrell Engineering and Heating Company, Cassells Street, North Bay, at a cost of $2,150. The wiring is by J. Read, Cochrane, at $150.

Colborne, Ont.

The foundations are in of the Fire Hall and Lock-up. The work is to be done by day labor. Material and equipment will be purchased by Reeve Samuel D. Dudley and Councillors R. Snetsinge and B. H. Boyle. City Clerk, H. S. Keyes; engineers, W. J. Jamieson. The building will be of cement block construction.

London, Ont.

Plans have been drawn for the erection of the church owned by the Latter Day Saints Congregation, 340 Maitland Street, at an estimated cost of $9,500. The owners are doing the general contracting, but may sub-let some trades. The construction includes one storey, 44 x 66, solid brick, concrete foundation, slate roofing, hot air heating, maple and pine floors, lime and sand plastering, wood lath. The architect is J. V. Munro, Bank of Toronto Chambers.

Maidstone, Ont.

The walls have been started of the $7,000 school under construction by David Croft, Maidstone, who will purchase material. The construction consists of one storey and basement, 34 x 40, brick construction. The Secretary of the School Board is Wm. Pettypiece, Pacquette Station. Architects, G. Jacques & Company, Bough Building, Windsor.

Metchedash and Tay Townships, Ont.

Work is to be started on the school for S. S. No. 8, the Secretary of which is Mr. W. H. Lovering, Lawson P. O. The contract was awarded to J. Orton, Front Street, Orillia. The mason work is to be done by Leigh Brothers; carpentry by Geo. Whitney and Lamb, Orillia; cement work by O. Cudworth, Orillia, and heating and plumbing by Purdy & Company, Mississaga Street W., Orillia. The general contractor is doing the interior fittings. The architect is J. H. Robertson, Orillia. The estimated cost is $4,500.

Montreal, Que.

The foundations are in for the alterations to the school at Greenshields, near Abraham. The owners are the Protestant Board of School Commissioners, Belmont Street; general contractor, M. Jeal, 263 Pine Avenue East. Estimated cost of alterations $3,400, to be of one storey, 45 x 50, concrete foundation, felt and gravel roofing.

Ottawa, Ont.

Tenders will be received until August 17 by R. C. Desrochers, Secretary Department of Public Works, for the partial removal of the tower of the Victoria Museum. Plans and specifications at offices of Thos. A. Hastings, Postal Station "F," Toronto, R. L. Deschamps, Dominion Buildings, Montreal, and the Chief Architect of the Department of Public Works at Ottawa; also at the office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

Port Colborne, Ont.

Tenders will be received until August 16 by C. M. Borter, architect, for the erection of a two-storey eight-roomed, brick school for the Board of Education. Estimated cost, $35,000. Plans and specifications with architect, and with Secretary of the Board, D. Alair.

Prince George, B. C.

Tenders are open and will be received until August 20th by the Minister, Provincial Government Department of Public Works, for the construction of a four-room school. Plans and specifications at the offices of T. W. Herne, Government Agent, Prince George, Mr. J. Mahoney, Agent, Vancouver, and Department, Victoria. The Deputy Minister is J. E. Griffith, Victoria.

Thetford Mines, Que.

Work has been started on the school under construction by Thos. Porter, Lower Ireland, Quebec, at a cost of $4,000. The owners are The Protestant School Board, the committee being Messrs. Pharo, Lipsey, McCallum and Halmmersmith.

Toronto, Ont.

The Ramsay Contracting Company are starting the foundation work for the incinerator which is to be erected at the Don Roadway for the Board of Control. The work is under the supervision of the Street Commissioner, Mr. G. B. Wilson. The Canadian Griscour Russell Company are the general contractors.

Tenders are open and will be received until August 17th for all trades for enlarging and additions to school on Eglinton Avenue, by the Board of Education, Secretary-Treasurer, W. C. Wilkinson, City Hall. Tenders will also be received for heat regulators and sundry trades in other schools.

Winnipeg, Man.

Work is to start at once on the church at River Heights, to be of 55 x 50 frame construction, and to cost $7,800. General contractors, Grey and Davidson Company, Limited, Wall Street; architect, D. W. Bellhouse, Canada Building; pastor, Rev. A. G. Sinclair; owners, St. Andrew's Presbyterian Congregation.

CONTRACTS AWARDED

Gravenhurst, Ont.

The contract for the $35,000 Sanatorium has been awarded by the Calydor Sanatorium, Limited, to E. Webb and Son, Messessage Street E. The general contractor will do all trades, the interior fittings and all woodwork being done by J. Orton, Front Street, Orillia. The architects are Burke, Horwood & White, 229 Yonge Street, Toronto.

Sherbrooke, Que.

The contract for the Market Building, King Street, at $7,400 has been awarded to Louis & Dakin, St. Gabriel Street. Engineer, Thomas Tremblay; Clerk, E. C. Gatien.

St. John, N. B.

The contract for Prince William Post Office fittings, awarded by the Dom. Government Department of Public Works to Rhodes Curry Company, Amherst, N. S. The estimated cost is $12,500. Tiling contract amounts to $6,000, and is let to the Italian Mosaic and Marble Tile Company, Manning Chambers, Toronto, Ont. The interior fittings are to be carried out by J. T. Schell Company, Kenyon Street, Alexandra, Ont. The architect is G. E. Fairweather, Germain Street, St. John, N. B. Secretary, Government Department, R. C. Desrochers, Ottawa.

Vancouver, B. C.

The contract for the two school buildings on Laurel and Tenth Avenue, amounting to $15,000, has been awarded by the University of British Columbia to Coffin & McLenan, 1701 Broadway W. The buildings are to be of one storey, frame construction. The architects are Sharpe & Thomson, 626 Pender Street West.

Winnipeg, Man.

The C. D. Kirk Company, of this city, have been awarded the contract for the installation of a heating and ventilating plant in the new George V. school. Architect, J. B. Mitchell, Winnipeg.

Business Buildings and Industrial Plants

Amqui, Que.

Work is to be started soon on the rebuilding, at a cost of $4,000, of the hotel in Richmond County owned by L. Pouliot, Amqui. General contractor, J. A. Brillant, Amqui.

Belleville, Ont.

Work is progressing rapidly on the store and theatre which are being erected here for the Griffin Amusement Company, Toronto. The building is scheduled for completion by October 1st. The architects are G. M. Miller and Company, Toronto, and the general contractor is George H. Holton, of Belleville.

Collingwood, Ont.

A by-law is to be submitted to the people by the Town Council on August 11th anent assisting the Bryan Manufacturing Company, of Minnesota Street, to rebuild planing mills recently destroyed by fire, the loss amounting to $80,000

Harrow. Ont.

Andrew Brimner, of this town, is the general contractor for a bank, store and lodge hall which are to be erected here for the Oddfellows Lodge at a cost of $8,000. The architect is Thomas Jenner, of Kingsville. The building is to be of brick construction, two storeys high, with concrete block and hollow tile.

Ingersoll, Ont.

Work is to start at once on the additions to the Borden Milk Company's factory on King Street West, 121 x 45. The contract has been awarded to John Hayman & Sons, 432 Wellington Street, London.

Montreal, Que.

Work is to be started soon on the Montreal Tramways Company's vaults, Craig Street W., to cost $5,000. General contractor, W. M. Irving, 26a Stanley Street ,who is carrying out masonry, carpentry, plastering, heating, plumbing, and interior fittings. Iron and steel work by The Phoenix Bridge and Iron Works, Limited, 83 Colborne Street. Electric fittings by the owners. Tenders are now being received for painting, concrete foundation, concrete brick fireproofing and steel consturction, electric lighting, ventilating system, plastering. Architects, Hutchison, Wood & Millar, Royal Insurance Building.

Work is in progress on the alterations to L. P. Mathys' store, 141 McGill College Avenue. The approximate cost of the alterations is $4,000. The owner is doing the general contracting. His address is 333 Viger Avenue. Sub-contracts are as follows;—brick, cement, and masonry, Fleury & Verville, 1292 De St. Valier Street; carpentry, A. Kelly, 1955 St. Urbain; heating and plumbing, A. Noel, 998 Ontario Street E.; others not let.

Nanaimo, B.C.

The owners of the Bijou Theatre (National Amusement Company, Vancouver, B. C.; Managing Director, W. B. Nichols) are figuring on plans for an addition to their building here.

Orillia, Ont.

Plans are in progress for the construction of store and storage on Mississaga Street, at an approximate cost of $5,000. Work, by day labor, is to start by October 1st. The construction will be of local brick, fireproof roofing, electric lighting, stove heating, metal ceilings. The owner is T. B. Cramp, 37 Barrie Road W.

Ottawa, Ont.

The clearing of debris for the alterations to the warehouse on Slater Street is being proceeded with, the approximate cost to be $6,000. The work is being done by day labor, but contracts for heating, plumbing and electric fittings may be let later. The owners are the H. N. Bate Realty Company, Canal St. Architect, W. E. Noffke, 45 Plaza Bldg.

Owen Sound, Ont.

Work is to start at once on the curling rink, at an approximate cost of $10,000. The owners, The Grey Rink Company, Limited, will furnish the steel, the general contractors being J. C. Kennedy, 781 Second Avenue West.

Simcoe, Ont.

Excavating is being proceeded with on Kent Street for the erection of a store and bond house, at an estimated cost of $5,000. The owner is John Sutton. Architect and general contractor, M. Dillon, Port Dover, who will purchase material. To be of two storeys and basement, 25 x 80, pressed brick construction, concrete foundation, electric lighting, concrete floors, wood and metal lath, plate and prismatic glass, freight elevator, cornices, metal beams, store fronts and fixtures, sidewalk lights, screens, weather strips, water wheels.

Stowe Island, Ont.

Plans have been prepartd for a boat house, estimated to cost $6,000, for W. H. Nichols, of the General Chemical Company, New York City. Architect, F. L. Lent, Gananoque, Ont.

Victoria, B. C.

The National Amusement Company, of Vancouver, (W. B. Nichols, Managing Director) are having plans prepared for the erection of a new theatre in this city.

Wallaceburg, Ont.

A concrete business block building will be erected in the Fall, at an estimated cost of $2,000, to replace one recently destroyed by fire. The owner is Samuel Collinger.

Windsor, Ont.

Plans are in progress for alterations to store on Sandwich Street W., to consist of plate glass, 1 freight elevator and store fronts, and to cost $3,500. Owner, W. C. Kennedy, care of Gas Company. Architects, Leybourne and Sewell, Sandwich Street E.

The walls have been started on the store and flats on Wyandotte Street. The owner is W. K. Kaplan, Wyandotte St.; architect, J. C. Pennington, Labelle Building. The building, under general contractor S. Berch, 33 Parent Avenue, to consist of two storeys, 70 x 35, brick construction and foundation. Contractor will do most of work except some by day labor.

Winnipeg, Man.

Interior work has started on the store and office building which are being erected on Portage Avenue, for D. S. Curry, at a cost of $225,000. J. D. Atchison and Company of this city are the architects and the Sutherland Construction Company, Limited, the contractors.

The walls are up of the stores under construction on Corydon and Lilac Streets, by Fraser & McDonald, 512 Gertrude Avenue, for W. & J. McBain. The estimated cost of erection is $7,000. Architect, G. G. Teeter, 401 Donalda Building. The general contractor is doing the masonry, carpentry and plastering. Other contracts are as follows:—roofing, Christie Brothers, 521 Henry Avenue; painting, F. Ball, 173 Sherbrooke Street; heating and plumbing, Beairston Plumbing Company, Limited, Fort Street; electric fittings, McDonald & Willson Lighting Company, Fort St.

Residences

Berlin, Ont.

Dr. L. A. Alvin Koeppel, 59 King E., is considering the erection of an apartment building on Frederick Street. The rough plans call for 16 apartments of 5 rooms each.

Blenheim, Ont.

Plans are in progress for a $3,500 residence to be erected by E. L. Wedge on Chatham Street. The construction will consist of frame and Milton pressed brick, stone and concrete foundation, shingle roofing, electric lighting, concrete, maple and pine floors, lime and sand plastering.

Chatham, Ont.

Excavating is going on for the erection of a $3,300 residence on Cross St. by W. J. Campbell, 71 Raleigh Street. Architect and general contractor, Frank Sparks, Sands Street. To be of 2 storeys, 28 x 30, concrete foundation, brick veneer construction, shingle roofing, electric lighting, steam heating, maple floors.

Dalrymple, Ont.

The foundations of the $7,000 residence to be built by Geo. Ivory, Dalrymple, are in. The house will be of local brick veneer construction, stone foundation, shingle roofing, hot air heating, hard wall plastering. Architect and general contractor, N. E. Plews, Orillia.

Hamilton, Ont.

Plans have been prepared for a residence on Carrick Avenue, estimated to cost $3,000. The owner and general contractor is J. H. Honeyford. The house is to be two and a half storeys high, of brick construction.

Halifax, N. S.

The residence owned by E. A. Wood, care Wood Brothers, Limited, Granville Street, has now been roofed, and consists of 2½ storeys, 40 x 45. The architect is A. R. Cobb, Cragg Building, Barrington Street. General contractor, G. H. Wright, address care E. A. Wood. Masonry, roofing and plastering by general contractor. Painting by Harrison Brothers, 56 Barrington Street. Heating, plumbing and electric fittings, Longard Brothers, 213 Hollis Street. Interior fittings are being installed by the owner.

Keady, Ont.

Albert Hall, 9th Concession, Keady, Owen Sound, contemplates the erection of a $3,000 residence to replace the one destroyed by fire. Construction to be of brick.

London, Ont.

Excavating is going on for the erection of a $4,500 residence on Richmond Street. Owner, Miss J. Lashbrook, Richmond Street. Architects, McBride & Gilbert, Edge Block; general contractor, J. A. Stanley, 1053 Richmond Street, who will do most of the work and sublet some. To be two storeys, 25 x 32, concrete foundation, solid brick construction.

Montreal, Que.

The roofing has been started on the nine flats, under construction by Pascal Latreille, 3597 St. Hubert Street, at a cost of $5,000. The work is being done by day labor, electric fittings by Ovila Beaulieu, 2435 St. Urbain Street. To be two storeys, 7 x 32.

Plastering of the 2 double residences on Oxford Street being erected by Arthur Cloutier, 810 Durocher Street, Outremont, is now being proceeded with. Contracts are as follows: Roofing, Jos. Lamarche, 896 Drolet Street; plastering, owner; painting, O. Perras, 1162 Henri Julien Avenue; heating and plumbing, Mr. Laberge, care owner; electric fittings, G. Martel, 229 Bernard Street. The residences will cost $13,000, and will consist of 2 storeys, 31 x 37; brick construction.

The foundations of the two residences to be erected on Marlowe Street, near Cote Street and Antoine Road, by G. C. Anglins, Limited, 65 Victoria Street, are now in. They will consist of 2 storeys, 24 x 42, concrete foundation, terra-cotta construction, felt and gravel roofing, hot water heating. Estimated cost $10,000.

Napanee, Ont.

Excavating for the erection of Judge J. Madden's $6,000 residence has commenced, the work being done by day labor under supervision of architect, A. Stuart Allaster, 42 King Street E., Brockville. Building to consist of 2 storeys, 30 x 40; pressed brick, shingle roofing, hard wall plastering, mosaic tiling.

Ottawa, Ont.

Excavating has been completed in connection with the alterations to the residence on Wilbrod Street, owned by J. A. D. Holbrook, 25 Clift Street. General contractor, S. F. Smith, 449 McLeod Street. To be 26 x 31, solid brick construction. Heating and plumbing, R. Murphy, 411 Lisgar Street. Most of the other work is being done by the general contractor. Architect, J. Albert Ewart, Booth Building, Sparks Street.

The walls of the $5,000 residence on Bellwood Street, owned by the Oakland Land Company (address W. J. Spratt, Sunnyside Avenue), are up. To be of brick veneer construction. Contracts as follows:—carpentry, W. Fryer, 5 Glen Avenue; heating and plumbing, J. P. Band, 775 Bank Street; electric fittings, Dominion Electric Company, 417 Sparks Street.

Good progress has been made on the alterations to the apartment house which is being erected on Somerset Street by C. D. Joyce. The owner, Mr. Joyce, is in the market for interior fittings.

The roofing has been reached of the $20,000 apartments under construction by Chas. Holbrook & Son, 425 Somerset Street. They are to be of brick veneer. Plastering by Broo9ks and Davis; painting, owners; electric fittings, W. R. McCallum, 525 Bank Street.

The foundations have been started of the three residences on Melrose Street to be built by Foster and Marks, 11 Irving Avenue, at a cost of $5,000. To be of brick veneer, stone foundation. Plastering by W. Lethbridge, care Foster & Marks; heating, James Phillips, 1005 Wellington Street; plumbing, H. Lethbridge, 1st Avenue; electric fittings, Dominion Electric Company, 417 Sparks Street.

The roofing has been reached of the $5,500 residence on Woodlawn Street under construction by Cuthbert & Clark, 143 Hawthorne Street, for E. G. Brown, Hope Chambers. Work consists of stucco and brick veneer construction. Heating and plumbing by Thomas Watters, 288 Booth Street.

Port Elgin, Ont.

The construction of two residences at $1,500 each is contemplated by D. J. Izzard. They will consist of white brick construction, stone foundation, shingle roofing, hot air heating, electric lighting, pine floors. The old buildings now on the lot will be torn down and rough lumber used on new houses. Owner will purchase sash, doors, and trimmings. Work done by day labor, to start this month.

A. J. Vanderlick contemplates the erection of two residences at $1,500 each. They will consist of white brick construction, shingle roofing, hot air heating, electric lighting, pine floors. The owner will probably build this Fall by day labor.

Preston, Ont.

Excavating is being proceeded with for the construction of a $3,200 residence by Bernhardt & Spalding, King Street. General contractors, Kinzel & Sons. To consist of concrete block construction, concrete foundation, shingle roofing, electric lighting, maple, pine and concrete floors.

Quebec, Que.

The foundations are in for a $3,000 frame and brick residence to be erected on St. Luc Street by F. X. Turcotte.

The foundations are in for a $5,000 residence on Second Avenue, Stadacona, for J. J. Cameron. The general contractor is J. Bornais, of Limoilou. The building is to be three storeys high, of brick construction.

Excavating is in progress for a $5,000 house on Bourlamarque Avenue for Arthur Frenettte, who will put up the building himself. The house is to be three storeys high, of brick construction.

Excavating is being proceeded with for the erection, at an estimated cost of $5,000, of a residence on Charlesbourg Road by Esdras Lavoie, 288 Third Ave., Limoilou. Work by day labor. To consist of 3 storeys, 35 x 50; concrete foundation, frame and brick construction; tin and asbestos roofing; hot water heating.

Excavating is going on for the $3,000 residence to be erected on Sixth Street, between Second and Third Avenue, Limoilou, by Gab. Hamel, Third Avenue, the work being done by day labor. To consist of 2 storeys, 25 x 32, concrete foundation, brick construction, tin and asbestos roofing, electric lighting, stove heating.

Toronto, Ont.

A. Woolrich is to put up a pair of two and a half storey brick houses on Awde Street, at a cost of $7,500, and will let the smaller trades.

W. Williams has commenced the erection of two two-storey, brick, detached residences on Morrison Avenue, and will sublet the smaller trades.

The foundations of the detached residence, to be erected by R. J. Cole, 15 Northcliffe Boulevard, are in. The owner superintends construction and lets to smaller trades. To be of two storeys, 22 x 40, brick construction, shingle roofing, electric lighting, hot air heating, birch and spruce floors, mantels.

The walls are going up of the pair of residences being erected on Ellsworth Avenue (156-8) by Purton & Chennel, 634 Christie Street, at a cost of $4,500. The owners are letting smaller trades. Structures to consist of 2 storeys, 34 x 42; brick construction; gas lighting; hot air heating; birch and spruce floors.

T. J. Allen, 48 Oakmont Road, is erecting a pair of residences on Boon Ave., at a cost of $3,600, the work having now reached the stage of flooring. They are to consist of 2 storeys, 34 x 42; brick construction. Plumbing is by G. Hamilton & Company, 494 Dundas Street. Owner is still receiving tenders for other trades.

Excavating is going on for a detached residence to be erected on Lauder Ave. by W. Edmonds, 16 Biggar Avenue, at a cost of $5,000, to consist of 2½ storeys, 24 x 34, brick construction, hot water heating. The owner will let smaller trades.

Plans are drawn and tenders open for the erection of a pair of residences on Hope Street at a cost of $5,000. Owner and general contractor, who is also doing the carpentry and plumbing, C. A. Drew, 119 Nairn Street. Tenders are wanted on all other trades. Buildings to consist of 2 storeys, brick construction, hot air heating, gas and electric lighting, lime and sand plastering, mantels. Work has not yet been started.

Excavating is going on for the erection of a $3,000 residence on Mount Royal Avenue by Robert Stevenson, 627 Indian Road, who will sub-let smaller trades. To be of 2½ stores, brick construction, hot water heating, shingle soofing, electric lighting, lime and sand plastering.

Excavating is being proceeded with on Thorne Crescent, for the erection of a residence by J. Edmonds, 71 Oakwood Avenue, to cost $4,000 and to be of 2½ storeys, brick construction, hot water heating, gas and electric lighting, shingle roofing. Owner will sub-let smaller trades.

Work is to be commenced at once on the two detached residences to be erected by L. Bailey, owner, in trust, 30 Glenholme Avenue, who will sub let to smaller trades. They are to consist of two storeys, 20 x 42, brick construction and foundation, shingle roofing, hot water heating, electric and gas lighting.

Winnipeg, Man.

The $4,500 residence, under construction by R. C. Mitchell, 312 Florence Avenue, has now been roofed. Plumbing and heating are being done by C. C. Young Company, Limited, 1650 McDermot Avenue; electrical fittings, N. MacDonald, 280 Bartlett Avenue; painting by the general contractor.

Work is in progress on the $3,500 residence under erection on Rathgar St., between Nassau and John Streets, by W. Parker, 473 Beresford Avenue. The building is to be of two storeys, 24 x 38, stone foundation, frame construction, electric lighting, shingle roofing, hot water heating.

CONTRACTS AWARDED.

London, Ont.

The following contracts have been awarded in connection with the $6,000 residence which W. D. Thomas is erecting on William Street according to plans prepared by J. V. Munro, architect, of this city:—plastering, A. Dowell; painting and glazing, George Burdick; roofing, J. Whittaker; heating and plumbing, L. J. O'Dell—all of Toronto.

Ottawa, Ont.

The contract for the alterations and additions to the residence on Wilbrod Street of J. A. Holbrook, 25 Cliff Street, at a cost of $7,000, has been awarded to S. F. Smith, 448 McLeod Street. Architect, J. Albert Ewart, Booth Building, Sparks Street. The work consists of concrete block and brick construction, stone foundation, tar and gravel roofing, hot water heating, electric lighting.

Toronto, Ont.

In connection with the residence being erected on Neville Park Boulevard by J. T. Moore, 30 Brookmount Road, the following contracts have been let:—plumbing, Duffart Bros., 862 Kingston Road; heating, Pease Foundry Company, 118 King Street E.; plastering, E. Buridge, 395 Woodbine Avenue; painting, G. Over, 299 Woodbine Avenue; electrical work, A. Partridge, 11 Wayland Avenue.

The contract for plumbing and heating at the residence built on Pine Crescent for W. M. Miskelly, 174 Victor Avenue, has been let to James Fiddis, 60 Wineva Avenue, the contract for electrical work to Dawson & Palmer, 276 Waverley Road, and for plastering to S. J. Bailey, 73 Bedford Park Avenue.

J. M. Heale, 61 Oakmount Road, has let the contract for plastering a residence erected on Indian Road to James Robertson, 615 Lansdowne Avenue.

In connection with the residence erected at 56 Indian Grove, for Morden Neilson, 311 Gladstone Ave., the contract for electrical work has been let to W. B. Gibson, 27 Colborne Street, and for concrete work to the Ramsay Construction Compnay, 37 Indian Road Crescent.

The general, carpentry and masonry contracts for the erection of an addition to the residence at Wrentham Place and Roxborough Street E. for R. A. Beggs, Confederation Life Building, have been let to W. A. Nixon, 146 Ossington Avenue. Approximate cost, $6,000. Brick construction, shingle roofing.

In connection with the residence and garage in course of erection on Connaught Avenue, York Township, for E. B. Varey, 142 Melgund Road, the carpentry contract has been awarded to P. A. Schwalm, 469 Shaw Street, the contract for heating and plumbing to Robert Ross, 1349 Queen Street W., and for electrical work to Edwards & Coley, 655 Dupont Street.

The contract for plastering the residence erected at 34 Bracondale Hill Road for W. Murray, 72 Forest Hill Road, has been let to H. G. Finbow, 496 Manning Avenue,

In connection with the residence built on Wightman Avenue by Playter & Chapman, 176 Danforth Avenue, the contract for plastering has been let to C. W. Baldwin, 1026 Gerrard Street East.

In connection with the residence built at 96 Balsam Avenue by George M. Martin, 100 Wood Street, the heating, plumbing and electrical contract has been let to Hillier & Company, 2199 Queen Street E., and the plastering contract to White Bros., 55 Hunter Street. Painting not let.

The general contract for the erection of a pair of residences at 29 Auburn Avenue for Miss E. Dickens, 101 Gloucester Street, has been let to J. J. Leggatt, 82 Auburn Avenue. Brick construction, shingle, felt and gravel roofing. Estimated cost, $3,500.

Westmount, Que.

The following contracts have been let in connection with the residence built on Edgehill Avenue for C. W. Tinling, 456 MacKay Street:—masonry, carpentry and plastering, A. K. Hutchison, New Birks Building; tiling, James Walker Hardware Company, Limited, 253 St. James Street; roofing, Richardson, Simard & Company, 745 Clarke Street; heating and plumbing, J. Campbell, 456 Guy Street; electrical work, Vincent & Say Electric Company, 25 Union Avenue.

The contract for electrical work at the residence built at Redfern and Westmount Avenues by J. Quinlan, 4412 St. Catherine Street, Montreal, has been let to McDonald & Wilson Company, Limited, 99 Drummond Street.

Wiarton, Ont.

Work has been commenced on the erection of a rectory in connection with Trinity Church. The masonry contract has been let to F. Robertson and the carpentry contract to G. Hurbut. Approximate cost, $3,500. A quantity of stone is required.

Power Plants, Electricity and Telephones

Beverly Township, Ont.

The ratepayers have approved a bylaw to raise $4,500 for the installation of the hydro-electric system. W. Wood, of Rocton, is Clerk to the Township Council.

Govan, Sask.

The Scandinavian Rural Telephone Company, Limited, have let the contract for the construction of their system to Brown & McKenzie, Regina, at $3,400. Equipment has been purchased.

Guelph, Ont.

The walls of the $22,000 telephone building on Cork Street are up. The building is under the construction of the general contractors, P. H. Secord and Sons, Limited, 133 Nelson Street, for the Bell Telephone Company (head office, Montreal), and will be of two storeys, 33 x 52. Galvanized iron and roofing by Turnbull & Cutcliffe, care general contracttor.

Listowel, Ont.

Vote is to be taken on August 21st on a by-law authorizing the installation of hydro-electric system at a cost of $6,600. Town Clerk, Wm. Bright.

Milverton, Ont.

A by-law was submitted by the Town Council and carried on July 30th, for the installation of Hydro-Electric System. Town Clerk, W. D. Weir.

Mount Forest, Sask.

An extension of the telephone system, to cost $11,000, is contemplated by the Mount Forest Rural Telephone Company (Secretary, I. A. Monsees). The line is to be approximately 40 miles long, 88 circuit miles of wire connecting McFort, Mount Forest, Bagley and Brockington.

Palmerston, Ont.

A by-law has been carried to introduce the hydro-electric system. Town Clerk, H. Hyndman.

Southampton, Ont.

A by-law providing for the installation of a hydro-electric system at an approximate cost of $13,000 will be submitted shortly. Town Clerk, J. C. Eskford.

St. Hilaire, Que.

Tenders are open and will be received by the Municipal Council up to 6 p.m., August 23rd, for the construction of an electric lighting system. Plans and specifications are with the Secretary-Treasurer, J. E. M. Desrochers.

CONTRACTS AWARDED

Beaverdale, Sask.

In connection with the telephone system, owned by the Creekside Rural

Telephone Company, Limited (Sec'y-Treasurer, A. L. Ashdown), the contract has been awarded to Houston Lallman Company, Regina, at a cost of $4,952. The contractor will purchase material.

Winnipeg, Man.
The following contracts have been awarded in connection with the telephone building which is being erected here by the Bell Telephone Company at a cost of $45,000:—roofing, G. W. Reed & Company, Montreal; architectural ironwork, John Watson & Son, Montreal. The architect for the building is W. J. Carmichael, Montreal, and the general contractors are Anglins, Limited, Montreal.

Fires

Bridgeburg, Ont.
The barn owned by Jonas Sherk, of this town, was destroyed by fire last week, at a loss of $4,000.

Burlington, Ont.
The store owned by Taylor Brothers, of this town, was destroyed by fire last week, at a loss of $4,000.

Bury, Que.
L. H. Martin's sawmill has been destroyed by fire, with a loss of $8,000. Owner will rebuild. Machinery will be required.

Centreville, Ont.
A barn belonging to Alonzo Johnston has been totally destroyed by fire. Loss partly covered by insurance.

Fredericton, N. B.
A. E. Kilburn's residence and barn on the Woodstock Road have been completely destroyed by fire. Loss, $5,000.

Glace Basy, N. S.
The residence and store of Morris Silber, Reserve Street, has been burnt down and totally destroyed, the loss amounting to $2,500.

Gravenhurst, Ont.
The boat-building plant of H. Ditchburn & Company, Muskoka Wharf, has been partially destroyed by fire.

Hartland, N. B. (near)
A residence owned by Isaac Morehouse has been totally destroyed by fire.

Junetown, Ont.
Fire has destroyed the residence of J. A. Herbison. Loss, $3,000, partially insured.

Knowlton, Que.
Fire has destroyed the Y. M. C. A. Building, causing loss to the extent of $2,300. Matron, Miss Strathy.

L'Assomption, Que.
A carriage factory owned by T. Bedard Company was destroyed by fire, at a loss of $8,000. The owner will rebuild and require machinery.

Leamington, Ont.
A residence and barn belonging to A. E. Reach, Concession C., have been destroyed by fire. Loss $3,000.

Mitchell, Ont.
W. G. Wills' theatre has been totally destroyed by fire.

Norland, Ont.
Fire has totally destroyed James Bryant's sawmill.

North Bay, Ont.
The Gordon Lumber Company, Gache Bay, have suffered the loss of their saw mill, the destruction by fire amounting to a loss of $150,000, which is covered by insurance to the extent of $75,000.

Oneida Township, Ont.
Fire has destroyed a barn belonging to E. Herod, Caledonia. Loss, $3,000, insurance $2,000. Owner will build a barn of steel construction.

Ottawa, Ont.
Stables, owned by the Ottawa Transfer Company, Lisgar Street, have been damaged by fire. The loss, $3,000, is covered by insurance.

Ponoka, Alta.
The flour mill belonging to Alexander & Tugman has been destroyed by fire. Loss $5,000.

Port Moody, B.C.
The residence owned by Mr. James Latta, George Street, has been completely destroyed by fire. Partly insured.

Rosedale, B. C.
A shingle mill owned by Messrs. Lang & Rodd was damaged by fire, the loss amounting to $4,000.

St. Gerard Magella, Que.
Jean Carreau's residence and stable have been gutted by fire, with a loss of $5,000.

St. Johns, Que.
Mr. C. Pontre has had his barn and stables totally destroyed by fire, the loss amounting to $4,000. Partly insured.

Sudbury, Ont.
Fire has destroyed two residences and a barn on Station Street, belonging to Peter Taylor and Marko Genaro.

Warren, Ont.
A business block and a number of residences have been destroyed by fire. Approximate loss, $100,000. Owners, E. Langlois, residence; D. Laporte, hotel; S. Soufrine, store; M. J. Dubeau, post office; M. Burke, store; H. H. Roy, store and residence; A. Parisen, residence; Mrs. Chartier, residence; A. E. Parteishck, residence; Boyd & Roy, machinery shed and office.

Welland, Ont.
Fire has destroyed four residences on Second Street, the property of William Mitchell, Aqueduct Street. Loss, $5,000, partially insured.

Mr. Samuel L. Lambert suffered the loss of his roller rink on Dennistoun Street, totally destroyed by fire at a loss of $5,000. Insurance covers the damage to an extent of $3,000. It is expected that the rink will be rebuilt.

Westmount, Que.
The residence 1160-8 Selby Street, part owned by Mr. H. J. Ross, 180 St. James Street, Montreal, has been destroyed by fire. Repairs will be made shortly. The loss is to the extent of $4,000.

Miscellaneous

Clinton, Ont.
Byam & Sutter are receiving prices on fireproof roofing and Brantford artificial green roofing tile.

London, Ont.
J. Yokum, care of Hyman's Tannery, will be in the market shortly for all equipment necessary for the manufacture of oils and tanning fluids.

Moncton, N. B.
Prices on a planer, with calking knives, and on a 75-ton engine, standard gauge, are being received by E. R. Reid, Manager of the Minto Hotel.

A. R. C. Clarke & Son, 51 Water Street, are receiving prices on a trencher and small steam shovel for water and sewerage work.

Montreal, Que.
S. & A. Brochu, 294 St. Catherine St. E., are receiving prices and other information with respect to brick, cement, concrete mixers, glass, lumber, skylights, wood and graphite paint, plumbing fixtures and woodworking machinery.

Ottawa, Ont.
The Department of Marine & Fisheries, Ottawa, will receive tenders until August 16th for the construction of a wooden lighthouse on concrete piers at McQuestion Point, Renfrew County. Plans at office of the Department, and at the Post Offices, Pembroke, Arnprior, Renfrew, and Fort William, Pontiac County, Que.

Sandstone, Alta.
The Southern Alberta Refineries, Limited, Lougheed Building, Calgary, are receiving prices on machinery necessary for oil refining.

Trois Pistoles, Que.
J. H. Morine et Fils are receiving prices and other information with regard to cement, steel, metal lath, screens, seating, hot water boilers, hot air furnaces, pine and bass lumber, metal shutters and woodworking machinery.

Winnipeg, Man.
Josie & McLeod, 49 Gertie Street, are receiving prices and catalogues on hot water boilers, black, galvanized and cast iron pipes, ½-inch to 4-inch, hydraulic pumps, cast and galvanized iron fittings, radiation and valves.

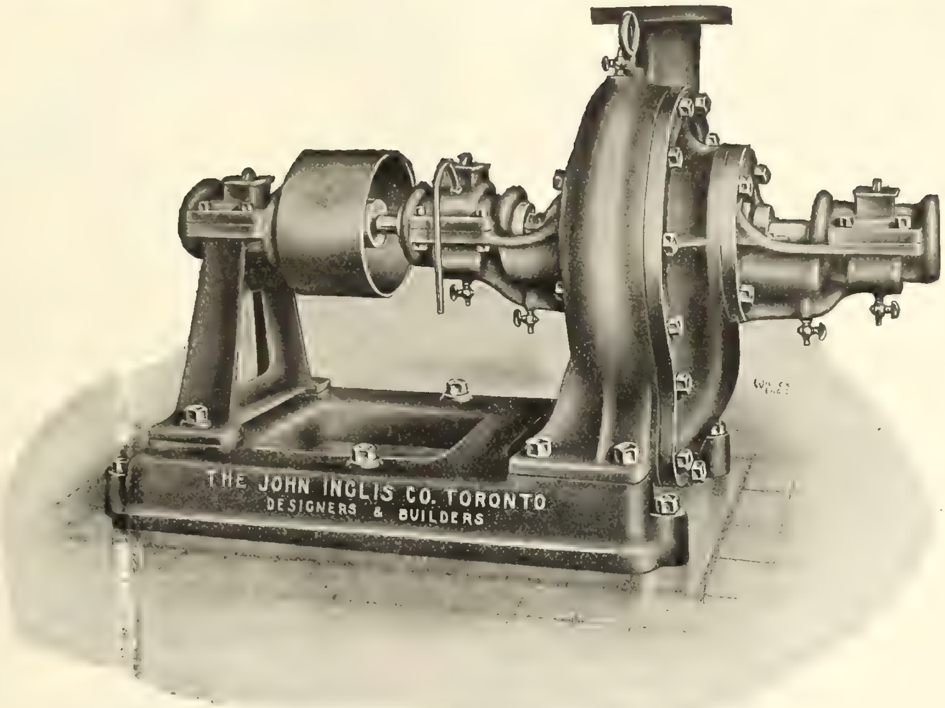
Market for Machinery in Switzerland

Perhaps never before in the history of Switzerland has there existed such promise for independent commercial progress as at present. The state of war, involving the principal nations of Europe, is responsible for much optimism in that country.

Many Swiss firms which have been dependent upon European representatives in surrounding countries for products coming from the Orient, England, and America, now look forward to independence when seeking to supply their own demands through importation. They believe that the time has arrived when it will be mutually advantageous for American manufacturers and exporters and Swiss buyers to establish direct connections.

Increasing demands are now being made upon foreign representatives in Switzerland for American goods, and indications are that they will continue to grow. One importer of American machines and machine tools states that his firm is receiving many substantial orders for American products, whereas goods manufactured on the continent of Europe were formerly in demand. He believes that during the war and for some time afterwards orders will be placed in Switzerland for machinery and tools which have previously been given direct to factories in surrounding countries.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

INGLIS' PRODUCTS ARE "MADE IN CANADA"

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Tenders and For Sale Department

Notice to Contractors

Incinerator

Sealed tenders, addressed to the Chairman and Members of the Board of Control, will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., **Thursday, August 26th, 1915**, for an Incinerator for the City of Ottawa.

Any tender received after the above stated time will be declared informal.

Specifications and full particulars may be obtained on application to the city Engineer's office, City Hall.

The Corporation does not bind itself to accept the lowest or any tender.

F. C. ASKWITH,
Acting City Engineer.

Ottawa, August 3rd, 1915. 32

Tenders Wanted

Tenders will be received by the undersigned, Township Clerk, up to 2 o'clock p.m. on **Saturday, the 21st day of August, 1915**, for the construction of Municipal Drain No. 3 in the Township of Maryborough, containing about 25,332.0 cubic yards of excavation.

Plans, profiles and specifications of this drain may be seen at the drug store in the village of Moorefield or at the engineer's office at West Montrose.

The lowest or any tender not necessarily accepted. Satisfactory bondsmen or a marked cheque for 5 per cent. of tender will be required.

W. W. SCOTT,
Clerk of the Twp. of Maryborough,
Moorefield P. O.

C. D. BOWMAN,, O. L. S.,
Engineer-in-charge,
32-33 West Montrose, Ont.

Tenders for Wrecking Buildings

Sealed tenders will be received, addressed to the Chairman of the Finance Committee, City Buildings, St. Catharines, up to 5 o'clock p.m. of **Tuesday, August 24th, 1915**, for the wrecking and removal of the following buildings on the right-of-way to the St. Paul Street Bridge.

3 Blocks of Brick Stores.
2 Brick Residences.
1 Large Stone Residence.
Barns and Sheds.

An alternative tender will also be received for the salvage of the lot of the I. O. O. F. property, together with their building.

Specifications and information regarding the work may be obtained at the office of the City Engineer.

Tenders will be received for each building separately or for all in bulk. A marked cheque for Fifty dollars must accompany each tender. The City does not bind itself to accept the highest or any tender.

W. P. NEAR,
31-32 City Engineer.

TOWN OF BURLINGTON

PROVINCE OF ONTARIO

WATER WORKS

Sealed tenders will be received by the Secretary of the Board of Water Commissioners until 8 p.m. on

Monday, August 23rd, 1915

for the construction of a

Reinforced Concrete Gallery

and connections thereto

Plan and Specification may be seen at the office of the Water Commissioners, Burlington, or at the office of the Engineers, 204 Mail Building, Toronto.

Lowest or any tender not necessarily accepted.

M. C. SMITH, Esq., Chairman.

JAS. S. ALLEN, Esq., Secretary.

CHIPMAN AND POWER, Engineers.

Toronto, Aug. 9th, 1915.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Partial removal of Tower, Victoria Memorial Museum, Ottawa, Ont.," will be received at this office until 4 p.m., on **Tuesday, August 17, 1915**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the offices of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F." Toronto, to Mr. R. L. Deschamps, Overseer, Dom. Bldgs., Montreal, and to the Chief Architect, Department of Public Works, Ottawa.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 5, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—83978. 32

WANTED

A superintendent for construction of a good class of buildings. State age, education and experience. Apply Box 231, Contract Record, Toronto. 32

TENDERS

Sealed tenders will be received by the undersigned up to noon on **Monday, August 16th**, for the construction of a Municipal Drain in the Township of Minto, known as Drain No. 6.

The drain is about 16,000 feet long and contains approximately 12,500 yards of excavation.

Profile and specifications can be seen at the office of the undersigned.

The lowest or any tender not necessarily accepted.

W. D. McLELLAN,
31-32 Clerk of Minto.
Harriston, Ont.

Public Works Department

JAMAICA, B. W. I.

Appointment of Superintendent of Public Works (2nd Class)

(1) Applications are invited from persons suitable for appointment as Superintendent of Public Works in Jamaica, there being one vacancy.

(2) Applicants, who must be between 25 and 35 years of age, must produce evidence of a good general education and of some technical training. They should have had at least five years' experience under a civil or mechanical engineer or contractor, and at least two years of that period should have been spent on works of construction. They should be good draughtsmen, able to take levels, make surveys, and prepare specifications and estimates for simple buildings and other works. They should also have some knowledge of accounts.

(3) Salary £200, to £250 by annual increments of £10, and in addition a personal allowance of £10 during the second year of service, increasing by £10 per annum until the maximum of £50 is reached.

Salary will be subject to the usual deductions, viz., 4 per cent. in respect of widows' and orphans' fund, and 2 per cent. in respect of pension. An allowance in lieu of travelling expenses is given to superintendents not stationed at headquarters. Security must be given to the amount of £300 or such other sum as the Government may require.

(4) The selected applicant will be required to pass a medical examination.

The appointment will be on probation for the first six months, and during the period of probation the services of the applicant selected may be dispensed with on one month's notice, given in writing, or on payment of one month's salary in lieu of notice. The cost of a first-class steamer passage from New York or Halifax to Jamaica will be refunded to the selected applicant.

Superintendents of Public Works (2nd class) are, after satisfactory service, eligible for promotion to the rank of Superintendent 1st class (£300-£400), and to the grade of inspecting Engineer (£350-£450).

(5) Applications, accompanied by copies of not more than three recent testimonials, should reach the Director of Public Works, Kingston, not later than September 15th, 1915.

J. H. W. PARK,
Director of Public Works.

Public Works Office,
Kingston, Jamaica, B.W.I.,
24th July, 1915.

For Additional Tenders See Page 58

Barrett Specification Roofs

(**Made in Canada**)

Investigate Roofing Claims!

GRAVEL and slag roofs laid along the lines of The Barrett Specification cover most of the first-class buildings of the country, because the experience of more than 60 years has proven that—

1st.—They last longer than any other kind.

2nd.—There is no painting, coating or similar maintenance cost.

3rd.—Their unit cost per year of service is lower than any other.

Claims regarding roofing should be met with this question: "How many can you refer to who have used say 500 squares of your roofing on a comparatively flat surface for ten years and bought more?"

Then investigate such claims!

We can supply scores of names for this purpose.

Exaggerated statements sometimes sell roofing, because the principles of Barrett Specification Roofs are not well known to the purchaser. Once he understands the long service they give, and the low unit cost, he will have no other kind.

Copies of The Barrett Specification free on request.

ROYAL BANK BUILDING, Toronto.
Architects, Ross & McDonald, Montreal.
Gen. Contractors: George A. Fuller Co., Limited, Toronto
Rfg. Contractors: G. Duthie & Sons, Ltd., Toronto

Special Note

We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired, however, the following is suggested.

ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified and subject to the inspection requirement.

THE PATERSON MANUFACTURING COMPANY, LIMITED
Montreal Toronto Winnipeg Vancouver

THE CARRITTE-PATERSON MANUFACTURING COMPANY, LTD.
St. John, N. B. Halifax, N. S. Sydney, N. S.

COUNTY OF BRANT

Sealed tenders clearly endorsed on the outside "Tender for Puttown Bridge Abutments," will be received by the Counties of Oxford and Brant up to 12 o'clock noon, on **Saturday, August 14th, 1915**, addressed to the County Clerk, County Building, Brantford.

(a) For Reinforced Concrete Abutments, and alternatively

(b) For Solid Concrete Abutments.

Tenders for either class must be on the prescribed forms and accompanied by a marked cheque for 5 per cent. of the amount of the tender made payable to the Treasurer of the County of Brant. Plans and specifications may be seen at the office of the County Engineer, from whom tender forms may be had, Room 4 Temple Building, Brantford.

ALAN MAIR JACKSON,
County Engineer.

31-32

TOWN OF THOROLD

PROVINCE OF ONTARIO

Sewerage System

Sealed tenders will be received by the Town Clerk until 8 p.m. **Wednesday, August 25th, 1915**, for the construction of a system of sanitary sewers in St. Andrews Ward, comprising about 14,225 lineal feet of pipe laying; also for the construction of sewage pumping station.

Sewer pipes are to be furnished by contractor.

Machinery to be furnished and installed by corporation.

Plans and specifications may be seen at the resident engineer's office, Thorold, or at the office of the chief engineers, Mail Building, Toronto, on and after August 13th, 1915.

The lowest or any tender not necessarily accepted.

JOSEPH BATTLE, Esq., Mayor.
D. J. C. Munro, Esq., Town Clerk.
CHIPMAN & POWER, Engineers.

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Late News Items

Beverly, Alta.

The walls of the school building being erected for the School Board by Henry Walk, Chaplin Street, at a cost of $13,500, are now up. Secretary of the School Board, H. L. Jordan. Architect, E. W. Morehouse, 30 Williamson Building. Brick veneer construction.

Danville, Que.

Tenders are open and will be received by the Secretary-Treasurer of the Municipal Council, C. B. Brown, until noon August 18th, for the construction of bridges as follows:—steel bridge 60 ft. between abutments 16 ft. wide, steel bridge 35 ft. between abutments 16 ft. wide. Plans and specifications with the Secretary-Treasurer.

Egremont Township, Ont.

A by-law is to be submitted shortly re hydro-electric lighting plant, to cost $3,000. Plans are in progress. Township Clerk, David Allan, Holstein.

Fort Frances, Ont.

Work has been started on the extensions to watermains on Victoria, Church, Crowe and Sinclair Streets. Town Clerk, J. W. Walker; engineer, W. Bishop; general contractor, East and Corrin, Fort Frances.

London, Ont.

Work is to start at once on 20 booths to be erected at a cost of $3,200, for restaurant purposes. The owner is the Western Fair Board (Secretary, A. M. Hunt, 21 Edward Street). Electric lighting, hardwood flooring, general appointments, system of lavatories and sewer required.

Ottawa, Ont.

Plans have been drawn for the erection, at a cost of $7,000, of stores, etc., by W. H. Lister, 127 Second Avenue, to consist of one storey, brick construction, concrete foundation, electric lighting, felt and gravel roofing, hot air heating, birch and pine floors, and plate glass.

The walls of the $6,000 apartments, being erected on Bethany Street, are up. Owners are J. Quinn, Bethany and Fairmount; general contractor, L. McDonald, 80 Fairmount Avenue. Building to be of three storeys, brick construction, stone foundation. General contractor will do all trades except brick work.

Province of British Columbia

The Canadian Northern Railway have the plans for station buildings at Port Mann, Chilliwack and Hope, B. C.

Regina, Sask.

The Saskatchewan Co-operative Elevator Company, of this city, have plans for the erection of elevators for the following points in Saskatchewan:—Theodore, Kanadar, Mortlach, Venn, Carlton, Truax, Eston, Wordsworth, Pontiex, Ogema, Maryfield, Hallbrite, Osage, and Richlea.

Sudbury, Ont.

Tenders are about to be called on a $4,000 residence to be erected on Paris Street for Mr. Aylmer Rogers. Architects, Angus & Angus, Sudbury.

Toronto, Ont.

Tenders close on August 17th for the construction of a sidewalk on Westlake Avenue. Plans and specifications may be seen at the office of the Works Department, City Hall.

The Chevrolet Motor Company, of New York City, have purchased the plant and premises of the Dominion Carriage Company on Perth Avenue, and will make alterations and additions to the building. The company expect to start manufacturing about November 1st.

The residence, in course of erection on Wells Hill Avenue, No. 65, is now ready for roofing. Owner is Mrs. Eakins, care of general contractors, Hall & Son, 6 Park Place. To be of two and a half storeys, brick construction, slate roofing, hot water heating, and to cost $10,000. General contractor employs regular staff to do all work on smaller trades.

Foundation work is started on the apartment house which is to be erected on Heath Street by John Walker, the owner and general contractor, at a cost of $25,000. Mr. Walker will buy the material and do the work by day labor, subletting smaller trades. The building is to be four storeys and basement, of brick construction.

Westminster Township, Ont.

W. Pitzpatrick, Westminster Cheese Factory, Belmont, has commenced work on a new corrugated iron building to replace one destroyed by fire and is also to erect a concrete boiler room. Will purchase boiler, general equipment, and corrugated iron for both buildings.

Weston, Ont.

Tenders are now being received by the architect, C. S. Cobb, of Toronto, for the erection of an auditorium here for the Toronto Free Hospital for Consumptives. The estimated cost is $5,000. The building will be of frame and brick construction.

Windsor, Ont.

Foundation work has been started in connection with the alterations to the building on Dougal Street, owned by J. F. Smythe, 150 Ouellette Avenue. Work is to be done by day labor at a cost of $3,500. Architect, J. C. Pennington, Labelle Building.

Winnipeg, Man.

Plans and estimates are being prepared for laying about twelve miles of gas mains for the city. Mr. W. P. Brereton is the City Engineer.

CONTRACTS AWARDED

Barachois de Malbaie, Que.

Charles Gamb and G. Maloney, of this town, have the contract for repairs to the Parish Church, estimated to cost $6,800. Architect, Thomas Raymond, Quebec.

Fort Frances, Ont.

The contract for granolithic sidewalks on Second and First Avenues and Mowat Street has been awarded to East & Corrin, of Fort Frances, at $10,000. The same firm has obtained the contract for sewer work on Armit and Church Streets and Crowe Avenue, at $10,000.

Fort William, Ont.

Machinery is being installed in connection with the additions to the elevator on the River front, owned by the Ogilvie Flour Mills, Limited, Front Street. The architects and general contractors engaged on the work are Barnett & McQueen, 20 Cuthbertson Block. Capacity of the elevator is 750,000 bushels. All work is being done under the supervision of the general contractor and is estimated to cost $130,000.

Kingston, Ont.

In connection with the residence to be constructed on Barrie Street for Dr. J. F. Gibson, 282 Queen Street, the following contracts have been awarded:—masonry, H. Watts, 98 Frontenac Street; carpentry, J. Peters, 44 Victoria Street; painting, J. Laird and Sons, 350 Princess Street; heating and plumbing, Taylor & Hamilton, 91 Princess Street. The architects are Power & Son, 81 Brock Street.

Ottawa, Ont.

The contract for the alterations and additions to the $7,000 residence on Wilbrod Street, owned by J. A. D. Holbrook, 25 Cliff Street, has been awarded to S. F. Smith, 448 McLeod Street.

In order to shift their concrete mixing plants over a distance of 17¾ miles in the construction of the Shoal Lake-to-Winnipeg Aqueduct, near Winnipeg, the contractors, Thomas Kelly & Son, have had three special self-propelling mixer car plants built. The Chain Belt mixers are mounted on 35-ft. standard gauge, 60,000-lb. capacity flat cars. The mixer and boiler are fed from the water supply by a duplex steam pump. Piping is so arranged that the overflow from mixer tank is carried back to the water tank. Concrete is shot direct from the mixer to the aqueduct forms through special "U" shaped No. 10 gauge steel spouts, each 18 ft. 9 ins. long, made in two sections, rolled to 24 in. diameter with a depth of 8 in. They are reinforced on each side with angles, with holes punched every 6 ins. for attaching supporting cables.

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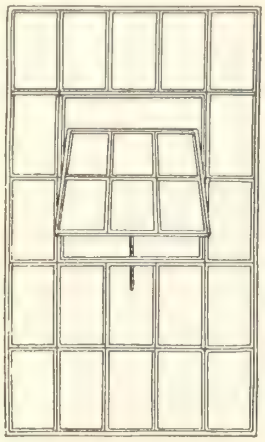

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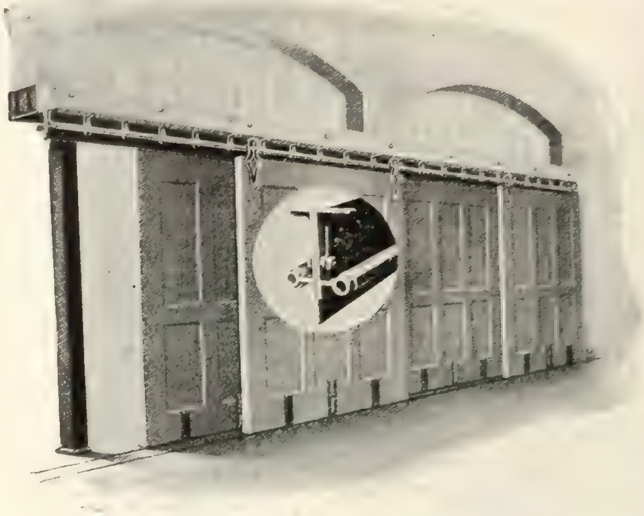

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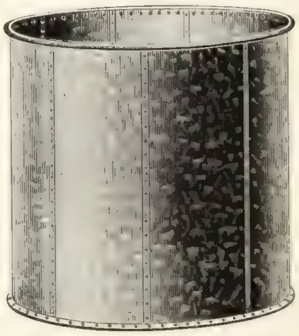

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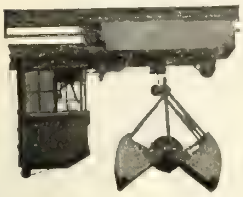

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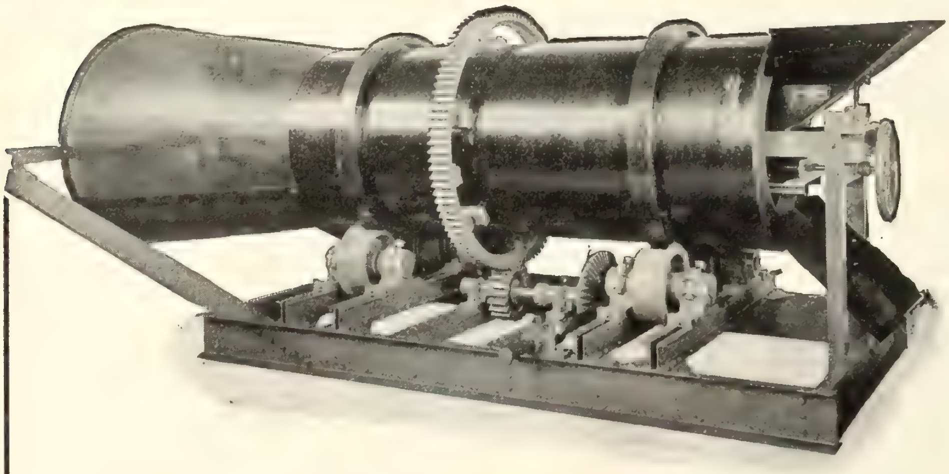

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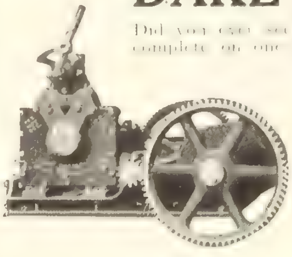

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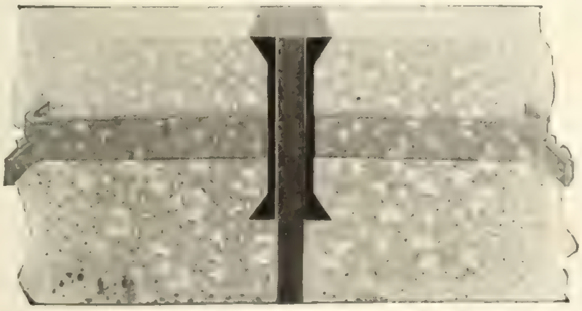

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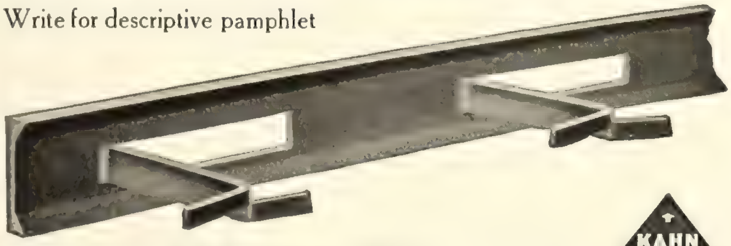

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Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.75; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. net cash. Copper bearing sheets—Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13½c basis; African hemp, 13½c.; sisal rope, 11½c. basis; lath yarn, 10¼c. Boiled linseed oil - in barrels, 72½c. per gal. of 9 lbs. Raw linseed oil—in barrels, 70c. per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20. Bags 10 cents extra.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots. f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $11.50 per 100 lbs.; boiled linseed oil, in bbls., 98 cents per gal.; raw linseed oil, in bbls., 95 cents per gal.; dry red lead, $10.00 per 100 lbs.; putty in bulk, $3.25 per bbl.; putty in 25-lb. tins, $3.75; turpentine, in bbls., 80 cents per gal. Mixed paint, ordinary colors, per gal., $3.10.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 350 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $9.00 f.o.b. warehouse. $9.00 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35 in car lots, $40 in warehouse; fire clay, $12 per ton in car lots.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.25 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galavanized iron—28 gauge, $5.75 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.00 in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal., $2.75 to $3.25.

White lead—ground in oil, $11.50 to $12.50 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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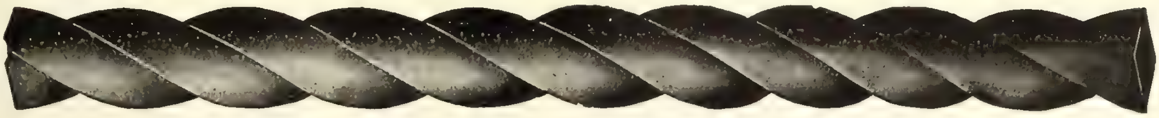

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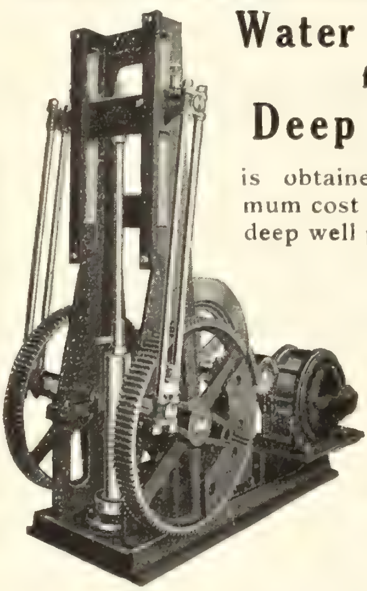

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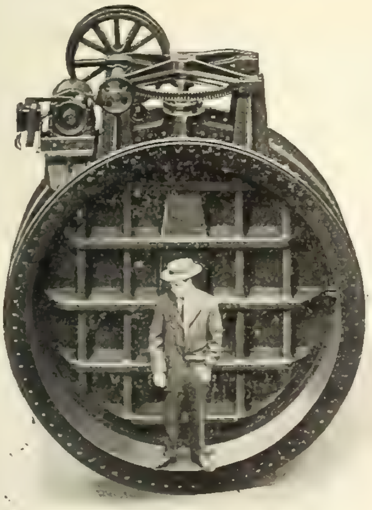

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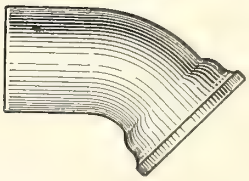

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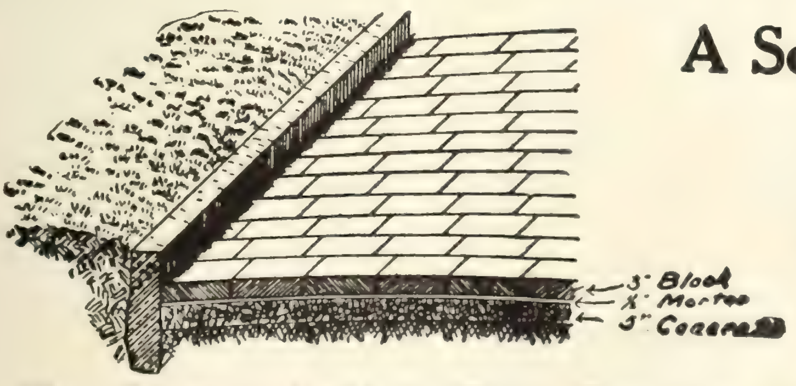

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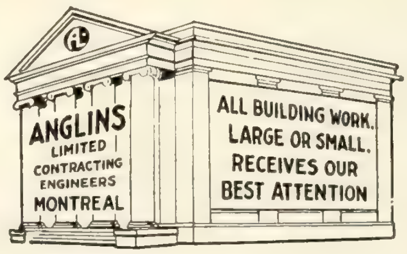
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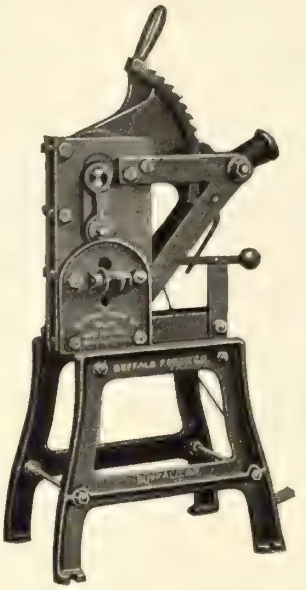

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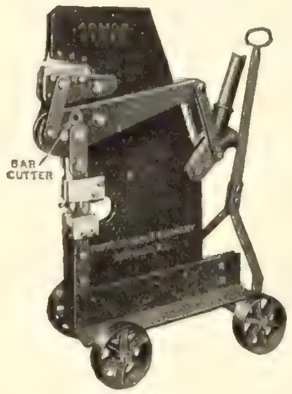
No. 625—Rivet Forge—18 inch diameter fire pan.



No. 5 Punch and Shear. Punches up to ¾ x ½ inch. Cuts Flats 6 x ⅝ inch.

***Send for
Catalog
179-12.***

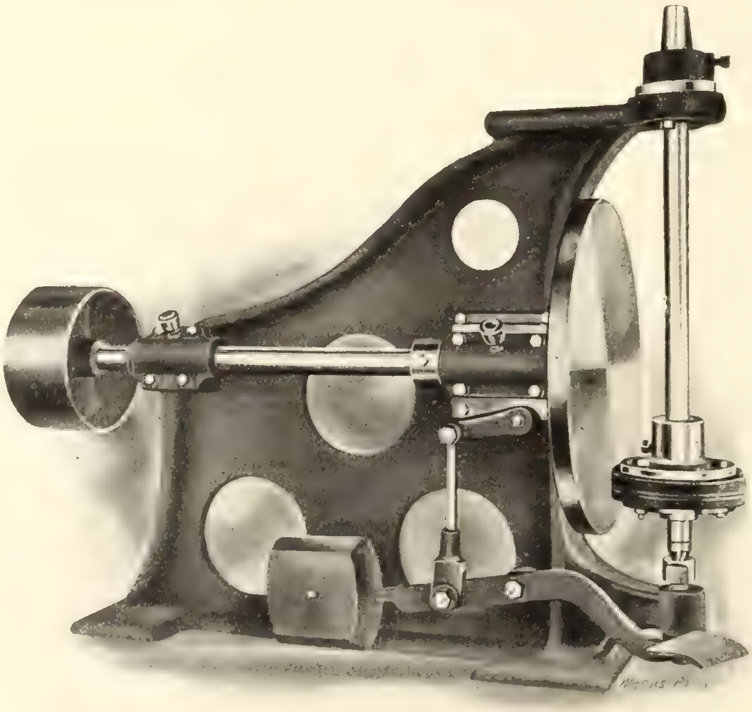
**Largest
Manufacturers
of
Blacksmith
Tools
in
Canada**

No. 125E Drill—Capacity up to 1½ inches.

Canadian Blower and Forge Co., Limited

BERLIN, - ONTARIO

St. John Montreal Toronto Winnipeg Vancouver



The

Crossley Line

of

Clayworking Machinery

Leads the Field

The illustration shows a new type of Jigger for making articles of clay formed by means of a profile or tool operated by a pull-down. Stands 3 feet high and has a speed of 250 revolutions per minute. We can furnish any style or shape of head to make any desired article.

We manufacture modern machinery for every branch of the clay-working industry.

Write for 180 page Catalogue containing full data.

THE CROSSLEY MACHINE COMPANY

TRENTON, NEW JERSEY, U.S.A.

BUFFS

We are in a position to supply buff pressed brick of a most attractive and uniform colour.

Superior Quality ***Prompt Service***

Interprovincial Brick Co. of Canada Limited

Goodyear Building, 154 Simcoe Street, TORONTO

Plant near
Cheltenham, Ont.

Montreal Agents
R. H. Miner Co., Limited
Coristine Bldg.

Made in Canada

XCELADUCT

(Galvanized)

AND

ORPENITE

(Enamelled)

Conduits

Orpen Conduit Company, Limited

Toronto

"DOMINION WIRE ROPE"

PRODUCTS

Minimize Your Troubles by Buying Our

BLOCKS, CLIPS, THIMBLES and WIRE ROPE

Stocks carried in Montreal, Winnipeg and St. Catharines

The Dominion Wire Rope Company, Limited, Montreal

Ransome Concrete Mixer

"The Machine with all the Good Features"

WHEN deciding upon a special concrete plant you should avail yourself of all the experience you can.

We will be pleased to submit designs of a plant to take care of your special requirements if you will send full particulars relative to the work to be undertaken.

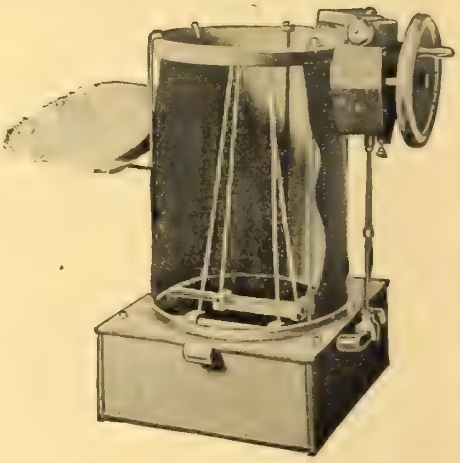
Catalogue upon request

Cement Bag Cleaner

An Inexpensive Machine for

Cleaning and Counting Cement Bags

Saves Cement that is ordinarily lost.



From one to two barrels of cement are saved out of every thousand bags.

When you return bags only partially cleaned, you not only lose the cement but pay freight on it as well.

Let us quote you

F. H. HOPKINS & CO.,

HEAD OFFICE
MONTREAL

Branches:—St. Catharines, Ont. 1206 Union Trust Bldg., Winnipeg Vancouver, B. C.

Vol. 29 Toronto, August 18, 1915 No. 33

ESTABLISHED 1886

Contract Record and Engineering Review

The Hamilton Bridge Works Co., Limited

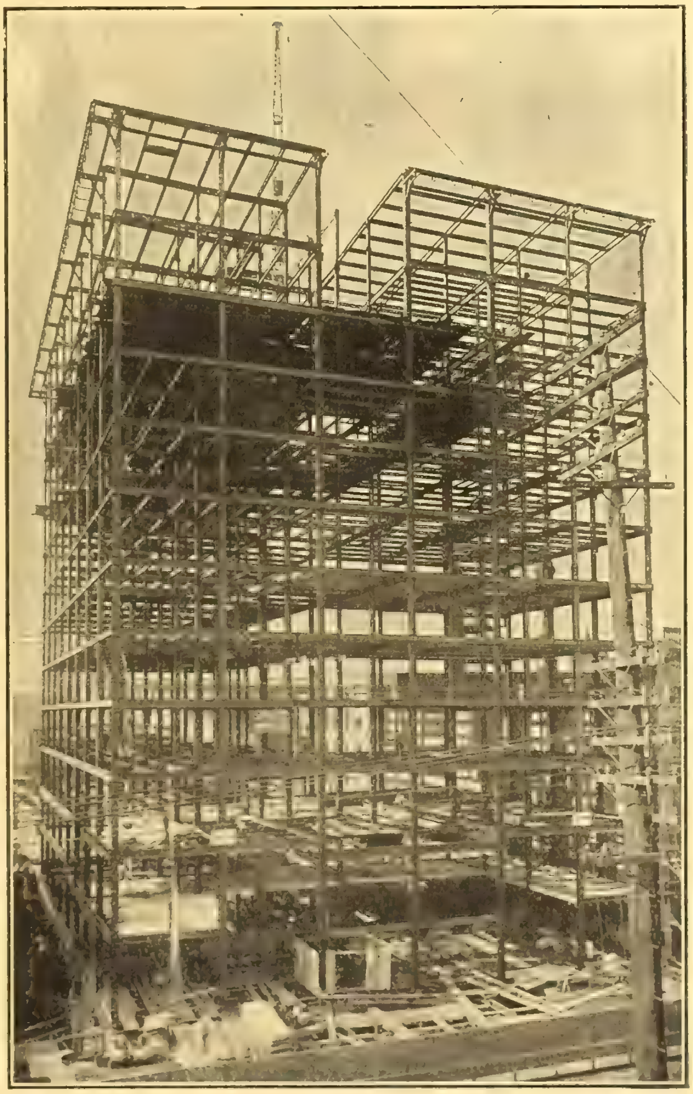
HAMILTON, CANADA

Engineers
Manufacturers
Contractors

Designers and Builders
of all Classes of
Metallic Structures

5000 Tons of Steel
IN STOCK

Annual Capacity
30,000 Tons



Structural steel for twelve storey building, Royal Connaught Hotel, Hamilton, manufactured and erected by us.

STRUCTURAL STEEL
For Every Purpose

STEEL TOWERS AND POLES
For
Electric Transmission
Lines
and other purposes

BUILDERS AND ARCHITECTS

We can furnish you on short notice with plain or punched Beams or Girders, and can submit close prices for any structural steel required for new buildings, or alterations to old ones.

Send us your enquiries.

BEAMS, GIRDERS, COLUMNS, TRUSSES, RODS, ETC.

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements Page 6

THE NORTHWESTERN TERRA COTTA COMPANY

C. P. R. OFFICE BUILDING
Darling & Pearson, Architects

DOMINION BANK BUILDING
Darling & Pearson, Architects

Two prominent corners in Toronto

The Terra Cotta for both buildings was manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

Chicago - Illinois

Agencies in all the large cities of Canada.

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

**28 "Service" Branches
Throughout Canada**

**Canadian Consolidated
Rubber Company, Limited**

Montreal, P. Q.

"STABILITY"

No matter how extensive your rubber goods requirements may be, we have an unrivalled experience, unequalled resources, and the financial stability to handle your order with maximum efficiency.

And furthermore, what is equally true—no order is too small to warrant our prompt and careful attention.

Our line-up is complete, our quality is unexcelled and our prices are right. Let us show you what we can do.

It is our desire to serve you.

**Canadian Consolidated
Rubber Company, Limited**

Montreal, P. Q.

**28 "Service" Branches
Throughout Canada**

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

To Secure

ECONOMY and DURABILITY

Construct Your

SEWERS

from

Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

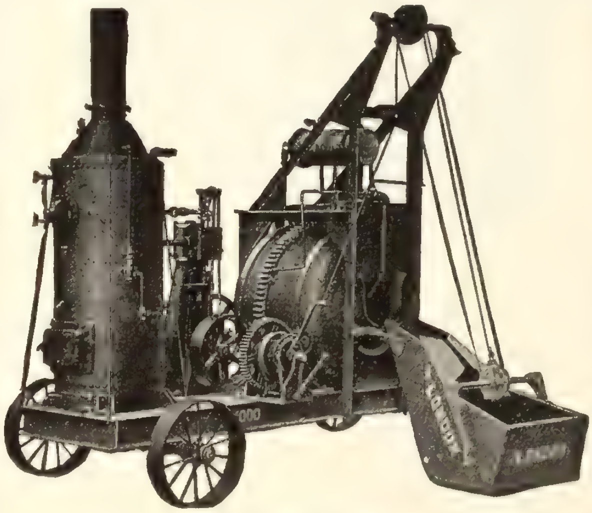
N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.

LONDON Batch Mixers

London Batch Mixers cost less because they will **run for years without repairs,** or break-downs. They produce more Concrete, they **make better concrete** and **do it in less time.** These features mean **clear profits** to the Contractor instead of loss.

Every Mixer Sold Sells Ten More. 2000 Now in Use.

Made in all sizes from ¼ yd. to 2½ yd. Batch. Get prices now before starting on the next job.



London Batch Mixer

Send for Catalogue No. 1.

LONDON BULL DOG BATCH MIXER

A Small Batch Mixer for Small Contract Work. 6 cu. ft. Batch, 50 cu. yds. per day. Can be operated with less men than any other Mixer. **Pays for itself in 15 days' use. Every contractor with small jobs should own a Bull Dog Batch Mixer.** Send for Catalogue No. 1B.

We make 23 different sizes and styles of Concrete Mixers also a full line of Concrete Machinery and Cement Working Tools.

London Bull Dog Batch Mixer.

London Concrete Machinery Co., Limited, London, Ont.

Branches and Agencies in every large city in Canada.

WORLD'S LARGEST MANUFACTURERS OF CONCRETE MACHINERY AND CEMENT WORKING TOOLS.

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

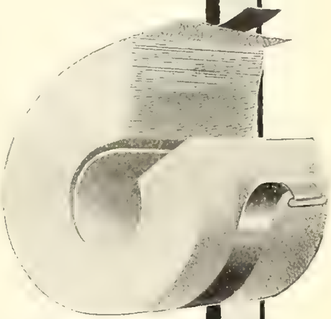
THIS emblem of J-M Responsibility represents a principle and symbolizes a pledge: the principle that every J-M Product shall render Full Service to its purchaser—a pledge that this principle shall be given force and effect through J-M Service that "covers the continent."

Don't Cover Your Pipes—*Insulate* Them

The only insulation for hot or cold surfaces that you can afford to consider is that which will return the greatest interest on the investment. This interest is computed upon the saving in the fuel bill and general increased efficiency. J-M Service seeks the opportunity of making an investigation of your individual requirements and of recommending insulation best suited to your particular needs. Also to prove to you by facts and figures just what saving we can accomplish for you. There is no problem in the field of hot and cold insulation that we cannot successfully take care of.

Tell our salesman of your insulation requirements. You will be given the services of our staff of insulation experts without obligating you to anything but a fair consideration of our proposition.

Our line of coverings meets every requirement to be found in the problem of insulation.



One style of J-M Heat Insulation for pipes over 4" in diameter.

The Canadian H. W. Johns-Manville Co., Limited

Asbestos Roofing; Pipe Coverings; Conduit; Metallic Hose;
Waterproofing; Mastic Flooring; Stack Lining; Packings; Etc.

Toronto Montreal Winnipeg Vancouver

SARNIA STEEL CEILINGS

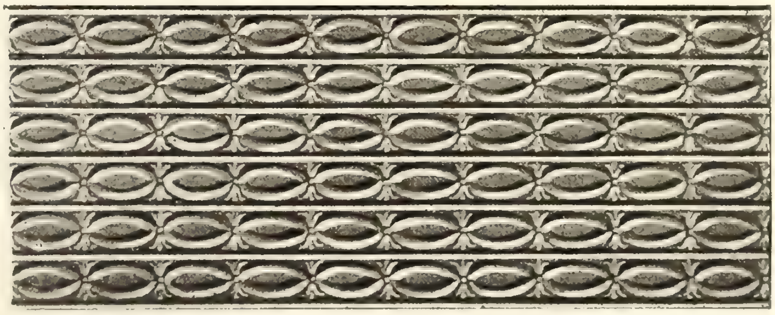
"QUALITY FIRST"

SARNIA M.P.Co.

Made in Canada

Metal ceilings and walls are particularly adaptable for use in stores, apartment houses, basements, school houses, etc., on account of its protection from fire and permanent finish.

Illustrated below is our Dublin Scroll design in walls, ceiling and cornice.



KILLERS CONTINUOUS HIP SHINGLES

We manufacture a complete line of Plain Galvanized Iron, Corrugated Iron, Metal Shingles, Ventilators, Sky Lights, Eave Trough, Volleys, Conductor Pipe, etc.

Write for descriptive literature and stock price lists.

SARNIA METAL PRODUCTS CO., Limited
SARNIA, ONTARIO

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Northern Crane Works

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Aikenhead Architectural Iron Works
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Hope & Sons, Henry
Ormsby Company, A. B.
Pedlar People Limited
Steel & Radiation Limited
Trussed Concrete Steel Co.

(Continued on page 12)

Simplex Piles
For A
Bank's Foundation

Simplex Piles were chosen for the foundation work of this large bank building because of their satisfactory performance in similar construction.

Bank of Toronto, Montreal
Atlas Construction Co., Ltd., Montreal—Contractors

151 Standard Simplex Reinforced Concrete Piles were used in this work and saved much time and money. The Simplex system was chosen in competition with caisson and other systems.

The Simplex Piles were placed close to adjoining walls which were dangerous.

The necessary plant was moved in and out of the foundation without obstructing street traffic.

If you have foundation work to do you should be acquainted with the possibilities of Simplex Piles.

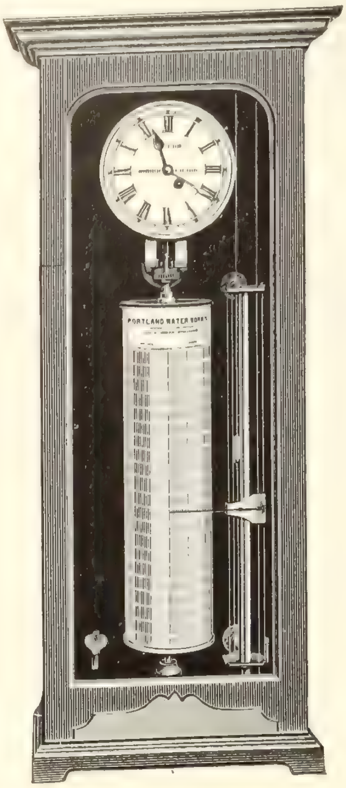
Write us.

Simplex Concrete Piling Company of Philadelphia

CANADIAN REPRESENTATIVES

Simplex Construction Company, Limited
Coristine Building, MONTREAL

"Simplex Piles Drive to Firm Footing"



The rise and fall of water in a Reservoir, Tank or Well can be accurately recorded in the Engineers Office, even if it is fifty miles away. The Transmitter will show locally the variation, and will send impulses to the Recorder for every inch rise and fall. The Recorder will show all this on the chart and the pen acts as a graphic indicator, and enables the level of the water to be seen at a glance.

The complete outfit, without batteries or line wires, with one year's supply of charts delivered free, duty paid any town in Canada

$350.00

Gent & Co., Ltd.
Leicester, Eng.
Cables, Lodestone

KERR
Gate Valves
and
Fire Hydrants
"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO

Waterproof Stucco with CERESIT

TRADE MARK REGISTERED

Make the stucco walls of your building **as water-tight as welded steel!** Simply throw a **small quantity** of Ceresit Waterproofing Compound into the water used to temper the cement plaster and you have walls as impervious to water as if laid with one slab of **seamless marble.**

You can make basements **as dry as attics,** and secure **permanent** and **economical** waterproofing results by using Ceresit for foundations, swimming pools, boiler pits, aqueducts, tunnels, dams, etc., and in all concrete, cement and stucco work.

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Walker's Limited, Winnipeg, Man.
E. G. Cullen, Vancouver, B. C.
W. B. Poucher, Edmonton, Alta.
Brown & Chapman, Regina, Sask.
Whitlock-Riddell Company, Moose Jaw, Sask.
MacKenzie & Thayer, Limited, Saskatoon, Sask.

Expert waterproofing engineers study your requirements and advise you freely to secure best results **for your clients.**

Write today for interesting literature.

Ceresit Waterproofing Co., **983 Westminster Building,** **Chicago, Ill.**

Stucco Walls Waterproofed with CERESIT

W. S. WARREN, Architect, La Grange, Ill.

Stucco Walls Waterproofed with CERESIT

I. M. GILBERT, Architect, Hinsdale, Ill.

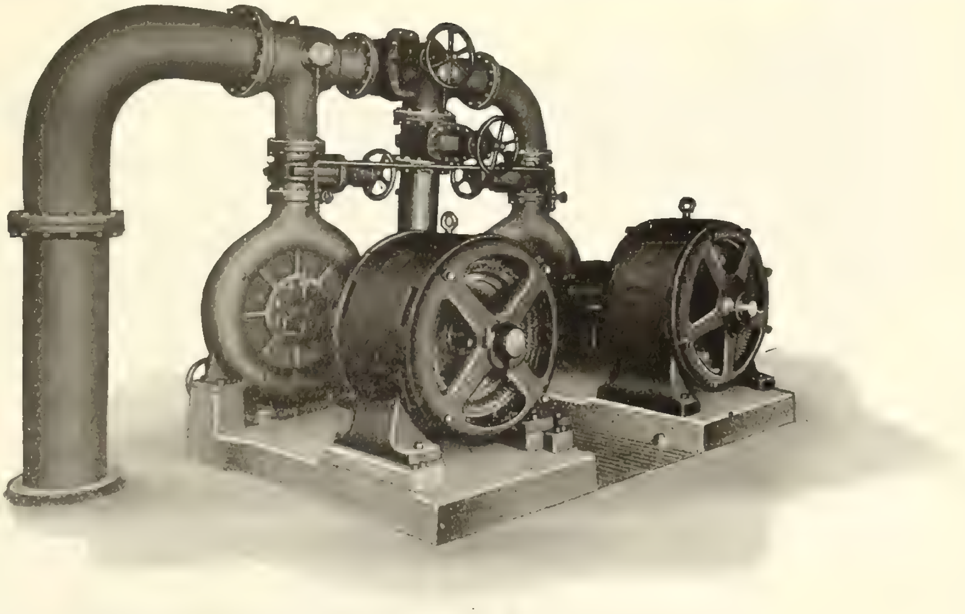
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Build Your Sewers Now

And Save Money To Ratepayers

Competition is very keen in all lines right now and ours has not escaped. Contractors need work and are tendering closer to rock-bottom than they have for many years. All material has dwindled in price. So has labor.

You can save 20% to 30% of normal cost by building your sewers now. The extra ½% or 1% that money costs is swallowed up by the saving on work.

—BUY NOW—

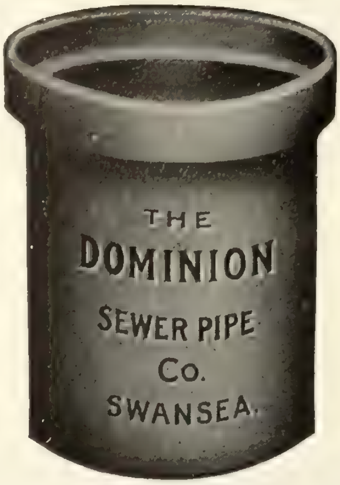
and keep the wheels of progress turning.

The Ontario Sewer Pipe Co., Ltd.
MIMICO, ONT.

SWANSEA

Salt Glazed and Vitrified

SEWER PIPES



True to Size
Impervious to Water.

Sizes manufactured and always in stock 4 in. to 24 in.

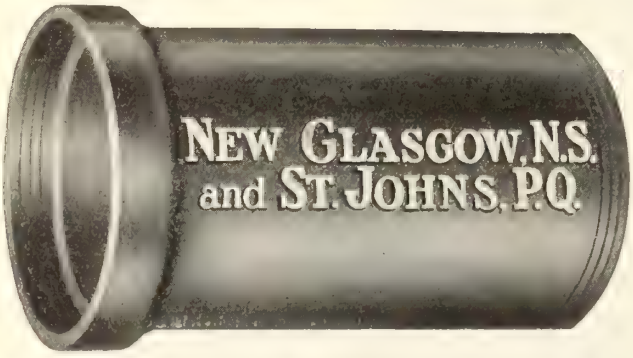
Ask for Price List and Discounts

also

Chimney Tops
Flue Linings
Wall Coping
Culvert Pipe
Inverts

Telephone (Toronto Connection)
Parkdale 5000

The Dominion Sewer Pipe Co.
(The Independent Co.) **Limited**
SWANSEA (near Toronto)



Sewer Pipes

High Grade Salt Glazed Vitrified Sewer Pipes and connections are a specialty with us. We also manufacture culvert pipes, inverts, flue linings, stove linings, fire bricks, locomotive blocks, gulley traps, range bricks, cupola linings, wall coping and all kinds of vitrified and fire clay goods. Prompt shipments on all goods.

Vitrified Hollow Building Blocks

Made in Canada with Canadian Clay, Canadian Coal, and by Canadian Workmen.

Standard Clay Products Limited

THREE SEWER PIPE FACTORIES: **St. Johns, P.Q., and New Glasgow, N.S.**
ALSO FIRE CLAY FACTORY AT ST. JOHNS, P.Q.

FOUNDATION WALLS

below grade level should be coated with Toch Brothers'

No. "R.I.W." 232

REMEMBER IT'S WATERPROOF

DAMP RESISTING PAINT

to prevent the penetration of dampness. This material also forms a perfect bond between plaster and brick or terra cotta wall. In addition to the saving of the cost of furring and lathing, which can be entirely obviated where No. 232 "R.I.W." is used, it eliminates the air space between plasters and wall. This space, in the event of a fire, forms a passage for flames, and is at all times a lurking space for vermin.

No. 232 and other "R.I.W." Products are fully described in the "Red Book." May we send you a copy?

Somewhere in the "R.I.W." line there is a paint for EVERY technical purpose.

MANUFACTURED IN CANADA BY

"R.I.W." Damp Resisting Paint Co. 202 Mail Bldg., TORONTO
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Dartnell, Limited, Montreal
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Write to nearest distributor for full information

WE BUILD MORE FANS THAN ALL OUR AMERICAN AND CANADIAN COMPETITORS COMBINED

Sturtevant Multivane Fans hold the high position they do because it has been proven conclusively that they deliver more air per horse-power than any other fan in existence. This higher efficiency is due to the cup-shaped blades.

A large stock of our regular sizes and types is carried in Boston, Philadelphia, Chicago and San Francisco.

Put your problem up to the largest and most capable body of trained fan engineers in the world.

B. F. Sturtevant Co. of Canada, Limited
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Vancouver

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McGregor & McIntyre

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Ceresit Waterproofing Co.

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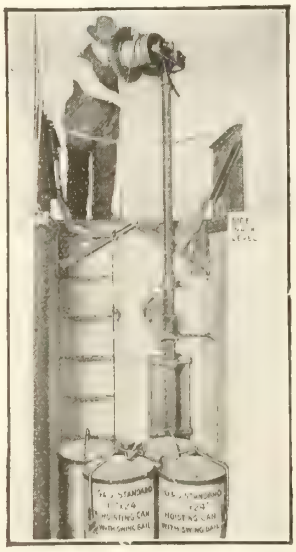

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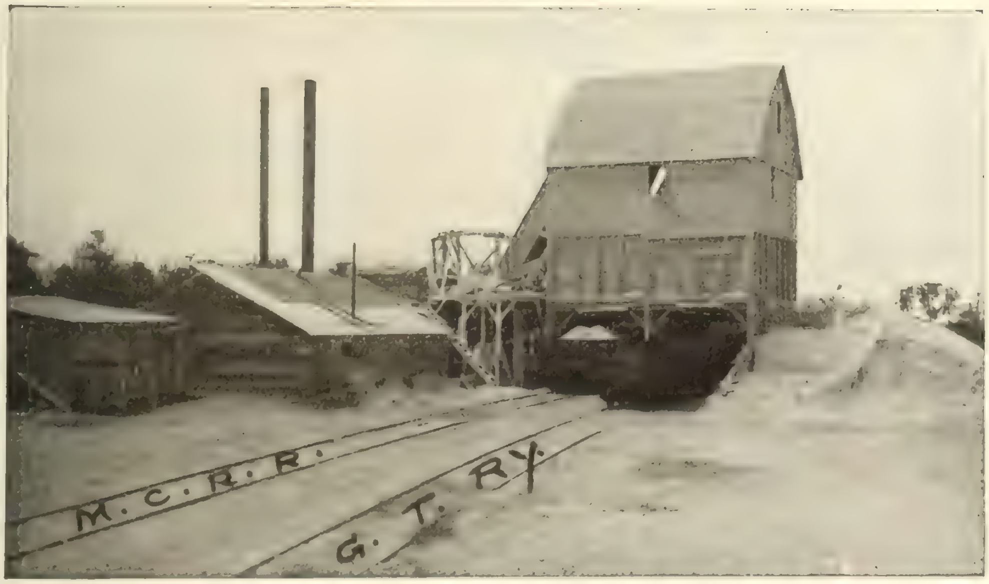

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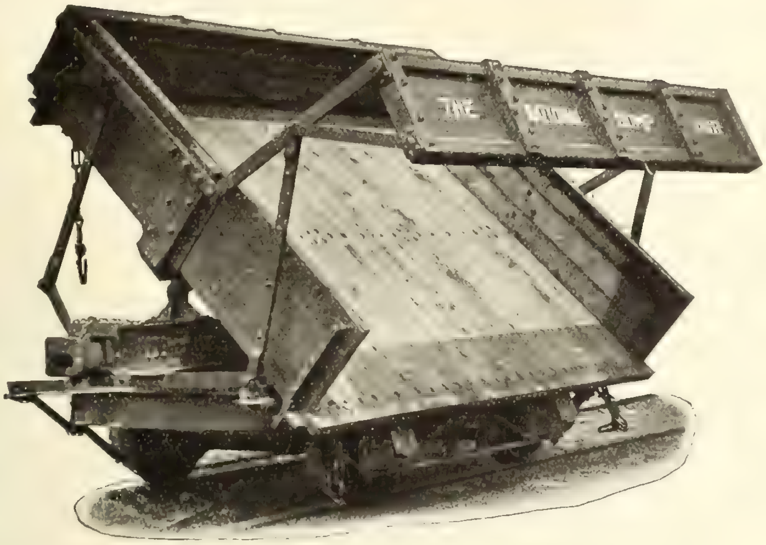

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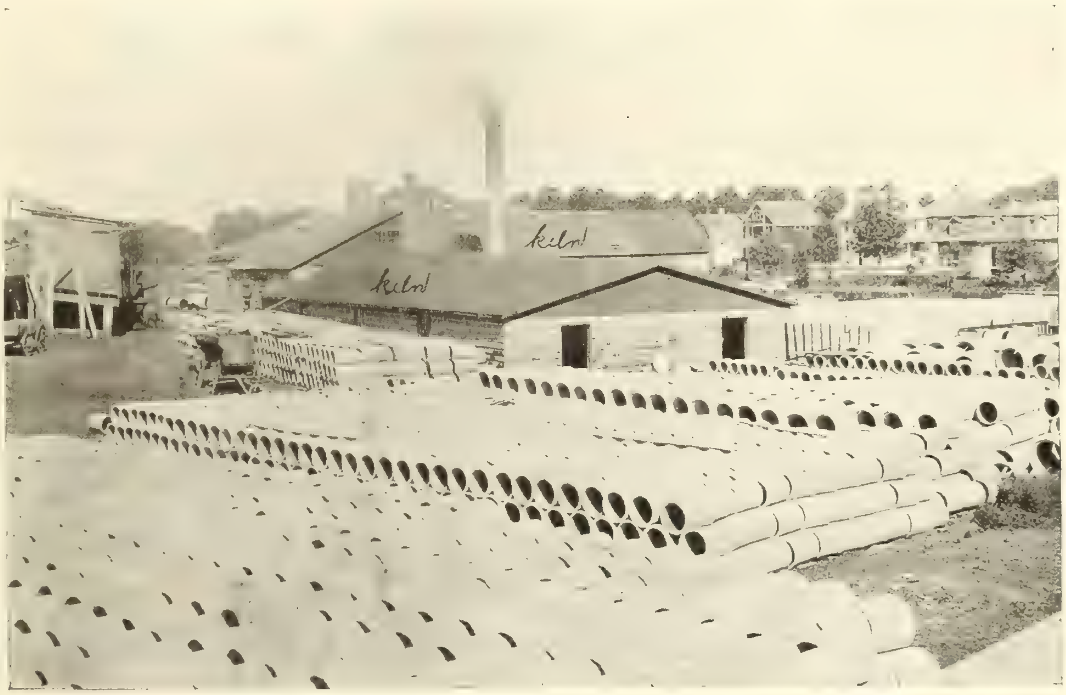

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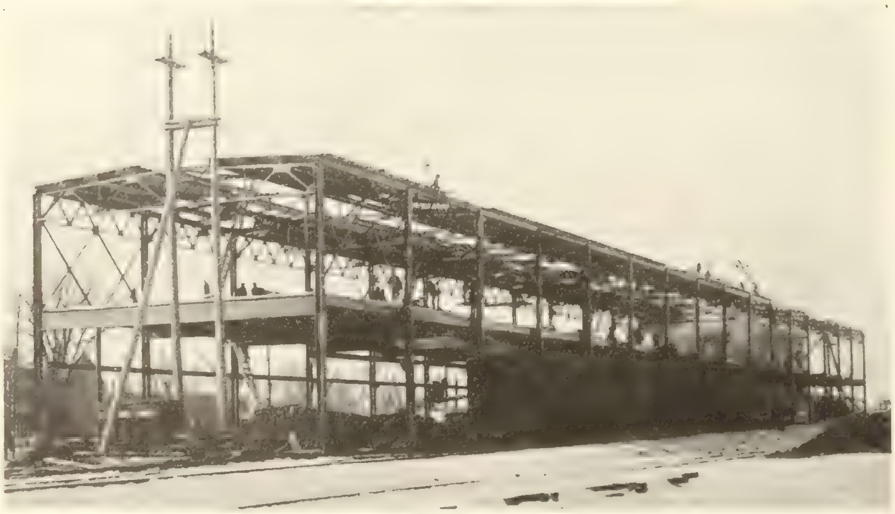

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Civic Stock-Taking

In most commercial undertakings it is necessary to take stock at least once a year, and in all concerns it is essential that this should be done as frequently as possible. This condition applies with equal force to civic matters—for, after all, the business of a city should be conducted like a large commercial undertaking.

When times are prosperous and money is fairly plentiful, there is a tendency to cast aside considerations of conservative progress. There is an impatience for rapid development, and the person who advocates more investigation into civic affairs when business is brisk is apt to be thought something akin to a knocker.

Now, however, with a serious check in the expenditure of money on new works, owing to the war and the depression, it is worth while thinking over civic problems and striking a balance sheet to show how the city stands—financially, ethically, and otherwise. This is the time for mature consideration of the needs of a city, and how best to attain them. This is the time, also, for engineers to investigate thoroughly problems of pure water supply, efficient sewage treatment, economical construction of roads and streets, satisfactory disposal of refuse, and so on. When the engineers are busy there is little time for study and investigation, or for comparing the results obtained in their cities with others. But in periods like the present an excellent opportunity is afforded for inquiries and comparisons.

It is by judicious correlation of data bearing on any branch of work that a reliable judgment as to the value received can be arrived at. If such comparisons and studies are not made the authorities may continue to perform their duties with an agreeable complacency to themselves, although others may observe the lack of efficiency and economy.

When Aldermen take a personal and intelligent interest in the affairs of a city, and devote as much time as possible to the study of the problems which have to be encountered, then the Engineer's labors also will be appreciated. And the Engineer in most instances will welcome the individual consideration of Aldermen, as it tends to unite them in their combined efforts to serve the citizens. It is the spasmodic and erratic manifestation of peculiar interest on the part of some Aldermen that disconcerts the officials, and often takes the heart out of them. The business of city administration cannot be learned by simply getting elected, or by casual inquiries; it needs persistent study, for each day brings new requirements, and each event produces new developments.

After a period of strenuous growth and great prosperity, our cities will do well to utilize the present quiet time to take stock of what has been done, and what is required to be done. It is well that the ratepayers should have a clear conception of what they own, what changes have been wrought in the last few years, and generally to know what the authorities and their officials have done on their behalf. And having established a firm grip of the situation, with its possibilities and duties, then those who have labored faithfully and well in the interests and welfare of the citizens should be encouraged to continue in their good work.

It is often found, when stock-taking, that some deadwood has accumulated—that some parts of a machine are not maintained as carefully as others, or that some department has conducted its business with efficiency and great economy. The weakness and lack of co-ordination of some branches will be discovered, and the power of others will shine out. But it is often at stock-taking that these conditions are established.

The Municipal Engineer who takes pride in his profession and the achievements of his department has nothing to conceal. Stock-taking to him will be a source of pleasure and satisfaction, for he knows that when properly conducted it will reveal many things that should be known—as that the water-works are maintained in excellent condition, and the cost, both capital and ordinary, is kept low; that the sewage treatment works are operated with care and intelligence, producing an effluent of satisfactory quality; and that the streets and roads are not more holey than good, but are kept in excellent condition, adding materially to the aesthetical side of the city.

Municipal works can be operated as economically as any other works—provided, of course, the officials are given a free hand to do their best.

Tunnel Construction in Flood Time

Specially contributed by Paul Seurot, Consulting Engineer, Montreal

IT is the writer's intention in this article to show how a subâqueous tunnel under construction is comparatively immune from the dangers attending an unusual flood. Floods within a subaqueous tunnel are not unusual happenings. They are one of the necessary evils of this type of construction and are ordinarily the result of a "blow," i.e., a sudden escape of compressed air through the face and the river bed, with a consequent inrush of water through the shield and into the heading. In the particular instance discussed in this article, however, the tunnel was flooded by water coming, at the rear, through the shaft and the approaches.

In the distance there may be seen the travelling crane over Shaft A under water. The building to the left is occupied by the various departments of the Foreign Office. When compressed air blew out a water spout was thrown on the roof of this building.

The tunnel under construction, known as the Invalides-Concorde Tunnel, was a section of the Paris Metropolitan Subway, passing under the Seine, between the Concorde and Alexander Bridges. Its length, including approaches, was 2,743 feet. It was circular in section, 25 ft. 6 in. in diameter, and the gradient of the approaches was five per cent. Work had been prosecuted from two shafts, A and B, on the left and right banks of the river respectively.

About January 10th, 1910, the Seine began to rise slowly, but there was nothing unusual about it. From all over the country, however, there were reports of continued rains which had so saturated the ground that there was a fear of heavy floods.

On the 20th of January, the water level had risen from datum 27.10 to elevation 30.00, 9 ft. 6 ins. above normal. The intersection of the streets back of the plant and shaft A is 820 ft. from the water edge when at the normal level, and its elevation is 30.846, or, in normal conditions, 12 ft. 3½ ins. above datum. The shaft itself was 689 feet from the water edge and its curb at about the same level, 12 ft. 3½ ins. above river datum. On January 22nd the river rose to elevation 31.50, 25¾ ins. above the street and shaft level, and the water began to back up through the sewer manholes and invade the streets and the works yards. Men were set to work building dams across the streets and around the site of the plant to save the works.

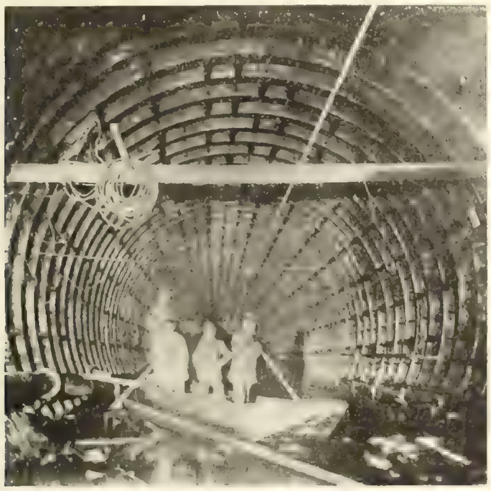
On the right bank of the river, the heading had already been invaded through the Nord-Sud Company's tunnels. This company, which now operates the Nord-Sud Railway, was flooded through the bursting of a large trunk sewer. The water poured in their works for a distance of 2¼ miles. Near the Madeleine, this company's tunnels pass over the line No. 8, of which the Invalide-Concorde tunnel is a portion. From the Madeleine overhead crossing, the water poured in the works of line No. 8 and came down towards shaft B until it reached the level of the river. Gangs of men had been set to work erecting dams in the tunnels between the Concorde and the Madeleine, but the difference of levels was such that in order to stem the invading torrents it would have been necessary to wall up the tunnels entirely, and there was no time for it. In the compressed air, the heading had been pushed well under the river bed, and work was going on without any trouble. However, as the water was still rising and threatened every minute to flow from the streets into the shaft, it was deemed prudent to get the men out of the heading, as they might be trapped in. Before leaving the heading, however, it was thoroughly grouted up. It was the intention, if the compressor plant did not fail, to keep the pressure in the tube and save the heading.

Meanwhile the water kept rising rapidly. At the Pont Mirabeau, where line No. 8 crosses the Seine a second time, and where the work was being executed by caissons, the plant was under water, and the intervening two and a half miles of finished or partly finished tunnels were threatened by the inundation. Part of them was already flooded, and men were busy erecting dams along the line—particularly at the high point of the profile between the two subaqueous tunnels.

On January 26th, the water level was 33.02, or 7 ft. 1¼ in. above the level of the street and of the works' site. Most of the pumps, dynamos, and other machinery had been hoisted up and removed to places of safety. The dams surrounding the shaft and part of the plant were still holding. Down in the tunnel, some of the dams erected about a mile up had been partly carried away and the water was beginning to flow in the masonry approach.

On the right bank, the troops had built earthen dams on the Place de la Concorde to protect the rue Royale, and with sand bags had raised the parapet wall, above the top of which the water had already risen; but it was useless as far as shaft B and the work on that side of the river were concerned. The water, stemmed a while on the river side, came from the sewers and through the Metropolitan tunnels. The Champs-Elysees was transformed into a huge lake, and the entire works were flooded.

On the other side the compressors were still working and the heading was safe. Water was beginning to invade the lower part of the Invalides Station of the Western Railway adjoining the plant. For more than three miles, this railway follows the shore of the river in a deep cut. Early on January 26th this cut was flooded and in the afternoon the water backing up to the station burst in the street and flooded the tunnel site, carrying all dams and protective works. Three compressors were running and the pressure was maintained so as to equilibrate the hydrostatic pressure at the face, but the pressure of the water above the sills of the lock doors on the normal air side as the danger now was that this pressure would tend to burst open the doors and invade the heading. Orders were given to raise the air pressure as the level of the water would rise. At 2 a.m. on January 27th the water level came up to elevation 33.20; a fourth compressor was set to work and the pressure kept at two atmospheres. At 3 a.m. the electric current gave out. One of the two electric plants supplying the power had had its cables broken or short circuited through the flooded ducts in the streets and the other plant was submerged.



The tunnel—when the water level had been lowered sufficiently to permit of salvage work.

Through the ever-increasing head of water, no longer checked by the air pressure, the lock doors probably opened. At that instant, and with a loud report, the air burst out and through the open shaft hurled a column of water, as a spout, 60 feet in the air, onto the roof of the Foreign Office building fronting on the other side of the street—shown in one of the illustrations. The pressure fell rapidly from 3.30 a.m. until 5 a.m., when the recording gauge showed a pressure of 1.5 lbs. At 8 a.m. it had fallen to zero.

The next day the water level reached its maximum at elevation 33.50, which is 21 feet above the normal river datum and 8 ft. 8½ ins. above the street level at the works' site and above the top of shaft A.

On January 31st the water began to recede slowly from the Esplanade and streets surrounding the works. On February 10 one of the electric plants was able to make some temporary connection and to furnish some power. Pumps were set to work, but it was done slowly and cautiously, so as not to overtax the capacity of the sewers into which the flood water from the cellars, basements and tunnels of the entire district was being emptied.

In the present case, the tunnel being the lowest point on the profile for a mile and a half in both directions, it came to the lot of the contractors to pump the water from their work as well as from adjoining sections. Of course, all of this was done at the expense of the city, a special appropriation being set aside to cover this extra work, as well as to indemnify the contractors for all just and proved losses due to the inundation.

Another serious problem was facing Paris and a great part of the country—a shortage of pumps.

All available pumps were requisitioned by the army and by the public services, and were bought or hired by the Metropolitan Railway, by other railway companies and private industries and citizens. All sorts of antiquated hand or steam pumps could be seen everywhere in the streets.

At the tunnel works, two of the big pumps had been left in the shaft. On the left bank two centrifugal pumps, one 8-inch and one 6-inch, were available with two 30 h.p. motors, and were set to work. To these were added, a few days later, two 4-inch centrifugal pumps. On the right shore all the pumps but one—an 8-inch pump—had been removed through shaft B and were put to work, emptying directly into the river. There were two 7-inch, one 6-inch, one 5-inch and one 3-inch—all centrifugal pumps. On this side of the river, the Nord-Sud Company, the Metropolitan Railway and other concerns were all doing their share of the salvage work, and on February 28th the water level had gone down sufficiently to resume work.

On the other shore the water had gone down to the bottom of the shaft and on March 8th had subsided to elevation 16.50, which is about 2 feet lower than the top of the material lock. Pumping was continued until the water was low enough to allow the doors of both material and men's locks to be cleaned and closed. The water level was then down to 15.00, which was about the level of the centre of the shield.

Air pressure was turned on on March 15. After cleaning the heading and the shield, work was resumed on the 22nd. There was no injury whatever to the tube or machinery. Only about 15 cubic yards of sand had caved in at the face. The packings of the rams and all the leather cups of the erectors had to be renewed, of course, and all the iron lining was cleaned with water under pressure, scrubbed from slime and the entire works disinfected.

A movement to secure the passage of a uniform state building law is now being carried on in Massachusetts. A special committee of the Boston Chamber of Commerce has appointed a sub-committee with Mr. C. H. Blackall, a Boston architect, acting as chairman, the purpose of this committee being to gather data and direct the chamber's attitude toward a bill now pending in the Legislature.

Are Refuse Incinerator Guarantees too Strict for Practical Fulfilment?

In which Mr. Sterling H. Bunnel, of The Griscom-Russell Company, New York, discusses refuse incinerator progress in the United States, and calls attention to the importance of good firing and the inadequacy of mere machinery to produce results. Attention is directed, also, to the letter dealing with this subject written by Mr. F. L. Decarie, of Montreal, published on page 867 of this issue.

A recent article in the Engineering Record reviews the development of refuse incineration in high temperature destructors, and puts forth the suggestion that the requirements of specifications have been too difficult for practical fulfilment. Refuse destructor plants are actually in successful and satisfactory operation in very many European cities. Requirements in European cities are generally more exacting than in American cities, so that it seems strange that there should be any difficulty in satisfying American city officials by the operation of destructor plants built in accordance with the best Europeon practice.

All engineers are familiar with the fact that the interpretation of specifications on rigid lines is often the cause of unfair requirements, and has more than once led to the rejection of plants which were in every way satisfactory except in some non-essential technical point. On the other hand, service boards and engineers have not the discretion permitted to the commercial corporation or private citizen, in insisting that the apparatus under contract shall be made broadly satisfactory. Being restricted in action by laws, the city official can hardly secure correction of defects unless such defects amount to a definite breach of guarantee. Not infrequently, therefore, the apparently unfair severity of interpretation of contract requirements is the only means of forcibly expressing dissatisfaction because of other and really serious faults not covered by the terms of the written guarantee.

The standard guarantees for destructor plant operation are not at all difficult for well designed furnaces to attain. They are generally:—

1. That no nuisance be created during the ordinary operation of the plant.
2. That no odors, obnoxious gases, smoke or dust escape from the chimney.
3. That the temperature in the combustion chamber shall not fall below 1250 degrees Fahr.
4. That the residue from the fires shall be hard, thoroughly burned clinker, free from organic matter.
5. That the weight of combustion per square foot of grate, the weight of evaporation per pound of refuse burned, and the labor cost per ton of refuse burned be within guaranteed limits.

The first two, while apparently difficult, are in reality easy of fulfilment. The collection and movement of garbage and refuse is in itself a disagreeable necessity, and a destructor plant can hardly be claimed to create a nuisance that already exists. Chimneys of destructors are usually not less than 125 feet high, and many are much higher; so that odors, gases, smoke and dust must escape in quantity to be observable at the ground level. The last three guarantee clauses depend entirely (and the first two to a large extent) upon the handling of the refuse into and through the firing process, which in the case of tests is usually in the hands of skilled men employed by the contractor. It is necessary to look outside of the working of the guarantees to find the points of general dissatisfaction which may drive the city officials to refusing acceptance on narrow technical grounds for that which will be a constant source of trouble later.

Of the scores of destruction plants in operation in cities outside of North America, the great majority have shovel-fed, hand-clinkered furnaces. In the smaller plants, the garbage and refuse is carted into the furnace room and dumped over the back of shallow bins, to be shovelled directly into the furnace doors opposite. The collected waste consists of a mixture of everything—wet, dry, combustible and unburnable together. The fireman casts out such of the stones, glass, large tins and pieces of metal as he can get at easily, and fires the rest of the mass as it comes. Naturally, the work of firing is not done when the material has landed on the gates. Refuse fires burn into holes, melt into large clinkers, and clog grates with metal fragments, and so need frequent stirring and levelling. Finally, when a mass of clinker and ash has accumulated and begins to block the draft, the fire must be thoroughly gone through and cleaned. No one familiar with the care required in firing even low grade coal would entertain the notion that a mixture of wet fuel and unburnable trash can be dumped in a heap upon grates and expected to burn to a uniform bed of ashes without frequent stoking by an experienced and watchful fireman.

Unfortunately, there has been a tendency in bidding on destructor plants for American cities to make impossible claims of low labor cost, based on the use of expensive mechanical charging and clinkering devices intended to operate without any manual labor. In this way several cities have been induced to accept the highest bid presented, and to install expensive and complicated apparatus, with the expectation of operating half a dozen high-temperature furnaces with 150 square feet of grate surface or more, at a cost per ton of refuse burned which contemplated the employment of a fire-room force totally inadequate to the situation. No amount of machinery, however ingenious, can do all the work of the competent fireman. In theory it would be possible to construct a boiler plant of enormous size, install coal handling devices and automatic stokers throughout, and run the whole plant by push buttons from a carpeted engine room at a distant point. In practice, machinery even of the rough and rugged character required in connection with boiler plant operation must be supervised and cared for; so that the most that can be hoped for is some reduction in the number of men required. With garbage fires, the variety of the materials to be burned makes impossible the uniform method of operation of the mechanical stoker system.

The bulk of the work of furnace tending, spreading the mass on the grates, filling holes in the fire bed, and clearing the fire of clinker, must always be done by hand labor.

The success of the destructor system of garbage and waste disposal depends on the ability of the firemen. The work does not require a high degree of intelligence, but does require steady, reliable service from the fire-room force. If this is clearly recognized city officials will save much in first cost of destructor plants by avoiding the inclusion of complicated apparatus intended to do what is impossible for machinery. They will thus secure furnace equipment of simple and durable construction, suitable for successful operation by the better class of common labor which is attracted by the steadiness of city employment.

Vitrified Brick Pavements for Country Roads

Abstract (by the Contract Record) of a comprehensive bulletin (U. S. Department of Agriculture) prepared by Vernon M. Pierce and Charles H. Moorefield—Chief of Construction and Senior Highway Engineer respectively of the United States Office of Public Roads

In forming a road bed upon which a brick pavement is to be constructed, the essential features to be considered are: (1) thorough drainage, (2) firmness, (3) uniformity in grade and cross-section, and (4) adequate shoulders.

Thorough drainage can be secured for any particular road only by means of a careful study of the local conditions which affect the accumulation and "run-off" of both the surface and ground water. These conditions vary considerably even in the same locality, and no set of rules can be given which would cover all cases. For example, the material composing the roadbed may be springy, and in this case the underdrains will probably be necessary. On the other hand, extremely flat topography may make it necessary to elevate the grade considerably above the surrounding land. The nature of the soil, the topography, and the rainfall must all be considered if a system of drainage is to be planned properly.

The second requirement, firmness, can be secured only after the road has been properly drained. Soils which readily absorb moisture cannot be properly drained in wet weather and should not be permitted to form a part of the subgrade. In order that the subgrade may be unyielding, it is also necessary that the roadbed be thoroughly compacted. In forming embankments the material should be put down in layers not over eight inches thick, and each layer should be thoroughly rolled. In excavation care should be exercised, if the material is earth, not to permit plows or scrapers to penetrate below the subgrade. The subgrade in both excavation and embankment should be brought to its final shape by means of fine grading with picks and shovels and rolling.

When completed the subgrade should be uniform in grade and cross-section, otherwise the foundation must be made unnecessarily thick where depressions occur, in order that its grade and cross-section may be uniform and its thickness not less at any point than that required. The subgrade should be repeatedly rolled and reshaped until the desired shape is secured. If curbs are constructed independent of the base they should be set before the final finishing, in order that they may be made to serve as a guide for this work.

The shoulders should never be less than four feet wide and should consist of some material which compacts readily under the roller and does not readily absorb water. Not infrequently one of the shoulders is made sufficiently wide to form an earth roadway parallel to the brick pavement. Such an arrangement serves to relieve the pavement of considerable traffic during favorable seasons and also affords some advantage to horse-drawn traffic. The general method of constructing shoulders for brick roads is not essentially different from that employed for other types of pavements.

Curbing

All brick pavements should be supplied with strong, durable curbing, both on the sides and at the ends. Otherwise the marginal brick will soon become displaced by the action of traffic, and their displacement will, of course, expose the brick next adjoining, so that deterioration might eventually spread over the entire pavement. Properly constructed curbing, on the other hand, will hold the pavement as in a frame and enable the brick to present their combined resistance to the destructive influences of traffic.

Satisfactory curbs may be constructed of stone, Portland cement concrete, or vitrified clay shapes made especially for this purpose. Wood has also been used for curbs to a limited extent, but when it is considered that the life of a brick pavement under ordinary conditions should far exceed the life of any wood curb which might be devised, the economy of employing a more durable material is readily apparent.

Stone curbing may be made from any hard, tough stone which is sufficiently homogeneous and free from seams to admit being quarried into blocks not less than 4 feet long, 5 inches thick, and 18 inches deep. On account of their ordinary homogeneous structure, granite and sandstone are probably more used for curbs than any other kind of stone.

All stone curbing should be hauled, distributed, and set before the subgrade is completed. The individual blocks should be not less than about 4 feet long, except at closures, and should ordinarily have a depth of from 16 to 24 inches, depending on soil conditions and on whether the curb is to project above the surface, forming one side of the gutter. The neat thickness need never be greater than 8 inches and, where the traffic conditions are not severe and the quality of the stone is good, a thickness of 6 inches will ordinarily prove satisfactory. Stone curb should always be set on a firm bed of gravel, slag, or broken stone, not less than 3 inches thick, or on unusually firm earth, and should be provided with a backing of the same material on the shoulder or sidewalk side. Fig. 1 shows a typical stone curb in place.

Where suitable stone is not readily available or when from any cause the cost of stone curbing would prove excessive, a curb constructed of Portland cement concrete may frequently be advantageously used. Concrete curbs may be constructed alone or in combination with either a concrete gutter or a concrete foundation. When constructed alone they should have approximately the same cross-sectional dimensions as stone curbs and should be constructed in sections about 8 to 10 feet in length. Figs. 2, 3 and 4 show the three common types of concrete curbs.

Vitrified clay curbing should be set in much the same manner as that described for stone curbing. The principal additional requirement is that, since vitrified clay is a lighter material than stone and the curb sections are ordinarily shorter, the bedding must be made correspondingly more secure in order to prevent displacement.

The Foundation or Base

A firm, unyielding foundation is one of the most essential features of a brick pavement. This fact can be more readily appreciated when it is considered that the surface of a brick pavement is made up of small individual blocks, any one of which might be easily forced down, causing unevenness in the surface, if the foundation were poor; and since the ability of the pavement to resist wear depends very largely on the smoothness of the surface, every reasonable precaution should be taken to prevent any unevenness from developing.

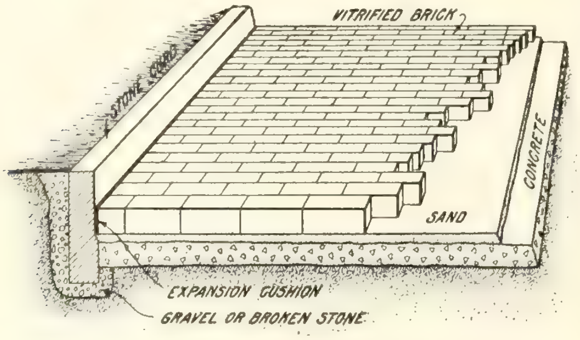


Fig. 1.—Proper method of constructing stone curb.

The proper type of foundation or base depends largely on the material composing the subgrade and the character of traffic for which the road is designed. Where the traffic is comparatively light and the subgrade is composed of some firm material which does not readily absorb water, a very satisfactory base may be constructed of broken stone. Where the traffic is comparatively heavy or where the material composing the subgrade is at all unstable, a monolithic concrete base should be used. Bases consisting of a course of brick laid flat upon a previously compacted layer of gravel or broken stone have sometimes been used, and pavements constructed upon bases of this kind, ordinarily called "double-layer" pavements, have in general proved satisfactory. At the present time, however, such bases can rarely be constructed at less cost than the more durable concrete bases, and they will therefore be given no further consideration here.

Broken-stone bases should be from 6 to 8 inches thick after compacting and should be constructed in two or more courses, just as in the case of first-class macadam roads. The materials used should conform in all respects to the ordinary requirements for similar materials used in constructing such roads; that is, the stone should be clean, hard, tough, and durable, and should be graded in size between certain reasonable, fixed limits. It should be uniformly spread on the road, either from dumping boards by means of shovels or from wagons especially designed to spread the material as it is being dumped. Where whole loads are dumped in one place and then spread out to the required depth, it is very difficult to obtain uniform density. Usually those spots where the loads are dumped are more densely compacted than the rest of the base, and this lack of uniformity very soon manifests itself by producing unevenness in the surface of the pavement. Broken stone should be compacted in the usual manner by rolling the base with a power roller weighing not less than about ten tons, and sufficient clean stone chips to fill the voids should be spread and flushed into the base while the rolling is in progress. When complete the base should present a surface uniform in grade and cross section and parallel to the proposed surface of the finished pavement.

Concrete bases are unquestionably better adapted for brick pavements than any other type. They are practically monolithic in form, nearly impervious to water, and possess a relatively high crushing strength. All of these qualities may be obtained with a relatively "lean" concrete if the subgrade has been properly prepared. Under ordinary circumstances a satisfactory base may be constructed of concrete composed of 1 part of Portland cement, 3 parts of sand, and from 5 to 7 parts of broken stone or screened gravel.

The sand should be clean and well graded in size, and the stone or gravel should conform to the usual requirements for coarse aggregate to be used in concrete construction.

Foundations for brick pavements have also been constructed of planks laid on sand, and in some instances of sand alone. These foundations have seldom proved satisfactory for any great length of time, and can, therefore, be economically used only when the pavement is to be constructed of an inferior grade of brick.

Sand Cushion

Since it is practically impossible to construct an absolutely smooth base, and since there is always a slight variation in the size of paving brick, owing to slight differences in the amount of shrinkage at the time of burning, it is necessary to provide an adjustable cushion of some kind between the base and the brick for correcting these slight irregularities, in order to secure an even surface and a uniform bearing for the brick. Sand has been found a most satisfactory material of which to construct this cushion, and is almost exclusively used for this purpose. The proper thickness for the sand cushion will of course depend on the extent of the inequalities above mentioned. Two inches is the most usual thickness, and has generally proved very satisfactory. One and one-half inches, however, is in many cases entirely sufficient.

The sand used in the cushion should be moderately clean and free from pebbles. If dirt or vegetable matter is present, it will soon be leached out and cause unevenness to develop in the pavement, while pebbles prevent the brick from securing a uniform bearing and ultimately produce the same result. It is also important that the sand should be dry when spread, especially if it is fine, because a comparatively small amount of moisture increases the volume of fine sand considerably, and moisture when present is not, as a rule, uniformly distributed. Even if it were uniformly distributed at the start, some spots would dry out more rapidly than others while the spreading was under way, and a lack of uniformity would thus be produced in the cushion.

In forming the cushion the sand is uniformly spread over the base to a depth slightly in excess of that desired, and is then smoothed off by drawing over it a template shaped to conform with the cross section of the finished pavement. The length of the template is ordinarily made equal to the width of the pavement where this is less than about 25 feet, and equal to half the width for wider pavements. Timber guides may be laid in the same direction as the pavement for the template to slide on, or the curbs may be made to serve as guides where this is convenient.

After the cushion is spread and uniformly "struck off" with the template to a depth slightly in excess of that required, it should be thoroughly compacted by rolling with a hand roller weighing from 300 to 400 pounds, and any depressions which form should be corrected. This is necessary in order to secure uniform density and to prevent unequal settlement of the surface.

Handling and Laying the Brick

The brick may all be hauled and piled at convenient intervals along the sides of the roadway before grading is begun, or, if more convenient, they may be delivered as needed on the work. Hauling over the finished pavement with wagons until it is complete and opened to traffic should be avoided. If the bricks are delivered on the work as needed, they should be unloaded from the wagons outside of the curb and carried to the pavers, either by hand or in wheelbarrows. Plank trackways should also be provided over the newly laid pavement for the wheelbarrows when they are used.

The brick should in all cases be uniformly piled by hand on the new pavement conveniently close for the pavers, and each brick should be so placed that the regular operation of picking it up and placing it in the pavement will bring the best edge up. This method of handling the brick requires somewhat more labor than the common method of dumping them from wheelbarrows, but it eliminates to a great extent the practice of picking out and turning over chipped or kiln-marked brick after the pavement is laid. This is very objectionable on account of the disarrangement of the sand cushion, which is frequently occasioned.

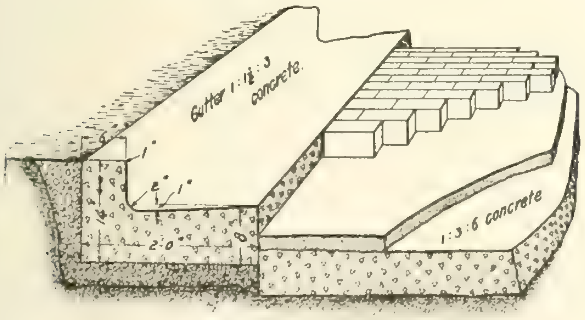


Fig. 2.--Concrete curb and gutter combined.

The brick should be laid on edge and in uniform courses, running at right angles to the line of the pavement, except at intersections; and in order to "break the joints" each alternate course should begin with a half brick. In laying the brick the pavers stand on the pavement already laid and, beginning at the curb each time, carry across as many courses together as they can conveniently reach. The courses should be kept straight and close together, and, if necessary, each block of eight or ten courses may be driven back by means of a light sledge and a piece of straight timber approximately 2 by 4 inches by 5 or 6 feet long, though no heavy driving should be permitted. The brick should also be laid close together in the courses.

After the brick are laid the pavement should be carefully inspected, for the purpose of detecting soft or otherwise defective brick. Misshapen or broken brick may be detected by the eye alone, and the soft brick by sprinkling the pavement with water. The soft brick appear comparatively dry while the water is being applied and comparatively wet after the sprinkling is stopped. All defective brick should of course be replaced by others which meet the requirements of the specifications.

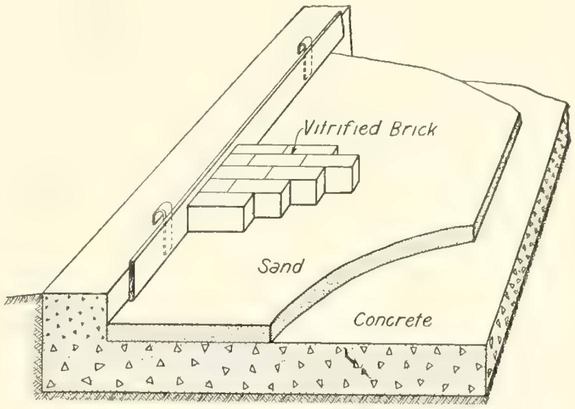


Fig. 3.—Making provision for expansion joint.

Truing the Surface

After the pavement has been laid and all defective brick have been replaced to the satisfaction of the engineer, the next step is to sweep the surface clean, and smooth out all inequalities by means of ramming and rolling. The rolling should be done with a power roller weighing from three to five tons, and the pavement should ordinarily be rolled in both longitudinal and diagonal directions. The longitudinal rolling should be done first, and should begin at the curbs and progress toward the crown. The roller should pass at least twice over every part of the pavement in each direction. In order to neutralize any tendency which the brick may have to careen under the roller, the number of forward trips over any part of the pavement should equal the number of trips backward over the same part.

In places where it is impracticable to use the roller for truing the surface—such, for example, as along the curbs or concrete gutters or around manholes—the brick should be brought to a true surface by means of ramming. For this purpose a wooden rammer loaded with lead and weighing from 80 to 100 pounds may be used. The blows of the rammer should not fall directly upon the brick, but should be transmitted through a 2-inch board laid parallel to the curb.

After the pavement has been trued up, as described above, it should be inspected again for broken or otherwise damaged brick, and also for those which have settled excessively, owing to some lack of uniformity in the sand cushion. All defects should be corrected, and the areas disturbed in making the corrections should be brought to a true surface by tamping or rolling.

Filling the Joints

In order to keep the brick in proper position and protect the edges from chipping it is necessary to fill the joints with some suitable material before the road is opened to traffic. The materials which have in the past been most commonly used for this purpose are sand, various bituminous preparations, and a grout made of equal parts of Portland cement and fine sand mixed with water.

Sand is the least expensive of these materials, but there are several very serious objections to its use as a joint filler: (1) It does not protect the edges of the brick; (2) it is easily disturbed in cleaning the pavement and is likely to be washed out by rain on steep grades; (3) it does not entirely prevent water from penetrating through to the foundation; and (4) it does not bond the individual brick together and so enable them to present a concerted resistance to traffic.

The bituminous fillers vary considerably in quality and efficiency, but all are more or less unsatisfactory. One of the principal objections to their use is based on their tendency to run out of the joints into the gutters during warm weather and to crack and spall out during cold weather. This tendency can, of course, be partially overcome by exercising proper care in selecting the materials. It should also be noted in their favor that brick pavements, the joints of which have been filled with bituminous preparations, are ordinarily less noisy at first than those in which a Portland cement grout filler has been used. The grout filler is unquestionably very much superior from a standpoint of durability, however, and the excessive noise under traffic which has been frequently observed in connection with its use can be largely eliminated by the use of proper bituminous expansion cushions along the curbs. It is, therefore, recommended as better adapted for filling the joints in brick pavements than any other material which has been commonly used for that purpose.

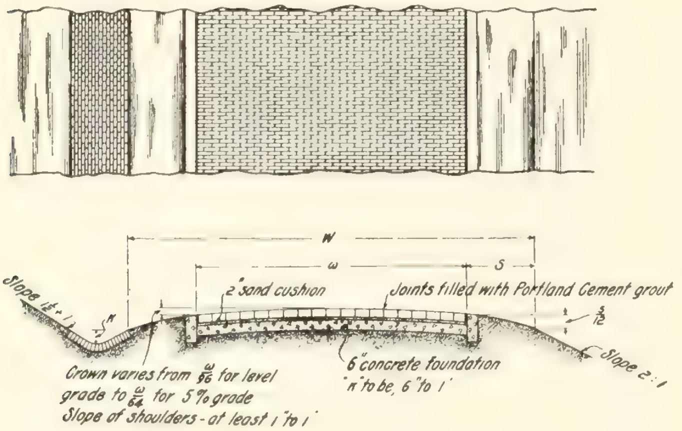

W
ω
S
2" sand cushion
Joints filled with Portland Cement grout
Slope 1½ : 1
H
$\frac{S}{12}$
Slope 2 : 1
Crown varies from $\frac{\omega}{96}$ for level grade to $\frac{\omega}{64}$ for 5% grade
Slope of shoulders - at least 1" to 1'
6" concrete foundation
"H" to be, 6" to 1'

Fig. 4.—Typical plan and section for brick road.

When the joints of a brick pavement are properly filled with Portland cement grout the individual brick are firmly bonded together and the pavement is thereby practically converted into a monolith. Moreover, since the material composing the joints scarcely wears more rapidly than the brick, the edges of the bricks are well protected, and the importance of this feature has already been pointed out.

The most satisfactory method yet devised for mixing and applying the grout filler may be described as follows: Grout boxes, constructed in such manner that when resting on a level platform one corner will be lower than the others, should first be provided. The number of boxes required depends on the width of the pavement; ordinarily one box to each 10 feet of width will be found sufficient. The grout, which should be put on in two applications, is prepared in batches each of which consists of a quantity of cement not exceeding one sack, a like amount of fine, clean sand, and water. The sand and cement should first be thoroughly mixed dry and sufficient water then added to produce a liquid mixture. The consistency of the mixture for the first application should be approximately the same as that of ordinary cream, and for the second application it should be somewhat thicker.

The pavement should be cleaned and thoroughly sprinkled as a preliminary to making the first application of grout, and it should be kept moist by gentle sprinkling while this application is being made. The grout should be swept into the joints immediately after it is removed from the boxes and spread upon the pavement. For this purpose a coarse rattan or fibre push broom should be used in the first application and a squeegee in the second application. The squeegee is usually made by clamping a piece of four-ply rubber belting or some other similar material, about 6 by 20 inches in size, between two pieces of board and attaching a suitable handle. The grout in the boxes should be continually stirred until the last of it is removed, otherwise a separation of the sand and cement will almost certainly occur.

The first application should proceed about 50 feet in advance of the second. Usually both applications are made by the same crew of laborers. They simply turn back after having covered the allowable distance with the first application and, mixing the grout in the same boxes, bring up the second application. The second application of grout should completely fill the joints flush with the top of the brick.

After the joints are filled as described above and the grout has taken its initial set, the entire surface should be covered to a depth of approximately 1 inch with sand or fine earth. This is done to protect the pavement from the weather and to keep it in a moist condition while the grout is hardening. If necessary, in order to keep the covering moist, it should be occasionally sprinkled for several days after it is spread.

The covering should be permitted to remain on the surface for at least ten days, and during this period the pavement should be kept entirely closed to traffic. If the weather is unfavorable, the length of time during which traffic is kept off the road should be increased.

Expansion Cushions

It has been customary in the past to provide both longitudinal and transverse bituminous expansion cushions in grout-filled brick pavements, but recent practice has demonstrated that the transverse cushions may be advantageously omitted if proper longitudinal cushions are provided. The principal objection to the use of transverse expansion cushions is based on the fact that the material composing the cushions frequently softens during warm weather and runs out toward the curb, thus leaving the edges of the adjoining brick exposed to destructive impact from the wheels of passing vehicles. Even if the cushion consists of a material which does not run in warm weather, it is necessarily softer than the brick, and the natural result is still the development of unevenness in its immediate vicinity. No such objection can exist concerning longitudinal expansion cushions, however, if they are placed adjacent to the curbs and constructed of proper material. They not only furnish a means for the pavement to expand and contract with changes in temperature, but they also eliminate to a large extent the disagreeable rumbling which has been so frequently associated with grout-filled brick pavements. The bituminous material of which the expansion cushions are made should be such as to remain firm in summer and not to become brittle in winter. It should also possess the quality of durability.

Expansion cushions should be provided for at the time the brick are laid, by placing a board of the required thickness on edge adjacent to each curb, as shown in Fig. 3. Small iron wedges, such as are shown, may be inserted between the curb and the board at the time the board is set. These wedges may be readily loosened and removed after the bricks have been laid and grouted, and may consequently be made to facilitate the removal of the board.

The proper thickness for expansion cushions is a matter concerning which much difference of opinion exists among highway engineers. Some engineers advocate a minimum thickness of 1 inch, while others claim to have secured their best results by using expansion cushions having a minimum thickness as low as three-eighths inch for very narrow pavements. It is generally agreed that the thickness of the cushion should vary with the width of the pavement. The following suggestions for proportioning the cushion are offered as being fairly representative of the best practice:

Ratio of thickness of cushions to width of roadway:—
Width of roadway, 20 ft. or less; thickness of cushion ½ in.; 20 to 30 ft.,—¾in.; 30 to 40 ft.,—1 in.; over 40 ft.,—1¼ in.

Cost of Brick Pavements

The cost of brick pavements varies widely and is affected by so many influences that it is difficult to attempt to derive a general expression showing the relation between probable cost and local conditions. The prices of brick, as also the prices of the various materials entering into the foundation, vary greatly according to the locality and the freight rate. The cost and efficiency of labor is also far from being constant. Furthermore, the material composing the subgrade and the method of preparing it may exert a marked influence on the cost of the pavement. The following statements regarding cost, then, must be considered as representing average conditions, and care must be exercised in applying them to special cases. They are intended as a guide in preparing estimates of probable cost.

The grading is usually paid for by the cubic yard, and the cost, of course, varies with the character of the soil and the necessary amount of excavation. In light, easily loosened soils, grading may usually be done at from 25 to 40 cents per cubic yard. In hard earth containing more or less loose rock the cost per cubic yard generally runs from 40 to 75 cents, while grading in solid rock may sometimes cost as much as $1.50 per cubic yard. The cost of the rough grading should be considered entirely apart from the cost of the pavement.

The cost of shaping and rolling the subgrade after the rough grading is completed will ordinarily vary from 3 to 5 cents per square yard. This cost should be included with the other items which make up the cost of the pavement.

The cost of the curbs varies with the character of the material used. Stone curbs ordinarily cost from 25 to 75 cents per linear foot, while curbs made of Portland cement concrete cost, as a rule, from 20 to 50 cents per linear foot. The higher prices for the concrete curbs apply principally to special cases requiring extra form work or considerable extra material.

The cost of the foundation depends largely on the cost of the materials with which it is constructed. Gravel or broken stone can usually be spread and rolled at from 5 to 7 cents per square yard, while the cost of these materials, delivered, varies from $0.60 to $2 per cubic yard. Mixing and placing concrete usually costs from 35 to 75 cents per cubic yard, according to the amount of work to be done and the methods employed, and the cost of the materials, delivered, ordinarily varies from $2.50 to $4.50 per cubic yard of concrete

The cost of paving brick at the kiln varies from about $13 to $16 per thousand. Estimating 40 brick to the square yard, each 1,000 brick cover approximately 25 square yards, which makes the cost at the kiln per square yard of pavement vary from 55 cents to about 65 cents. These figures mean very little, unless the kiln is located conveniently near where the brick are to be used, for freight charges not infrequently amount to more than the cost of the brick.

A force consisting of one paver and five laborers should place on an average about 220 square yards of brick per 10-hour day; while supervision, rolling, and incidental expenses are ordinarily equivalent to the cost of hiring about three and one-half additional laborers.

If C = cost of cement per barrel, S = cost of sand per cubic yard, A = cost of coarse aggregate per cubic yard, B = cost of paving bricks per 1,000, and L = cost of labor per hour, with all materials considered delivered on the work and all costs expressed in cents, then the probable cost of constructing a brick pavement, including the subgrade, a 6-inch concrete foundation, and suitable curbs, may be estimated by substituting in the formula:

$$\text{Cost per sq. yd.} = 1.90\,L + .213\,C + .138\,S + .157\,A + .040\,B.$$

The cost as estimated from this formula should usually be increased by about 10 per cent. to allow for wear on tools and machinery and to guard against unforeseen contingencies. If it is desired to use a different thickness of foundation, it is safe to assume that each inch subtracted or added to the thickness of the foundation will make a corresponding difference of from 8 to 12 cents in the cost per square yard.

Maintenance of Brick Pavements

If brick pavements are properly constructed at the start, the work of maintaining them is very slight. Under the closest inspection, however, some inferior material is likely to become incorporated either in the foundation or in the surface, and it is therefore very important that a brick pavement be very carefully watched for the first few years of its life to see that no unevenness develops either because of defective brick having been used in the surface or because of insufficient support from the foundation at any point. Whenever any unevenness develops, it should be immediately rectified. Otherwise the pavement will become irregularly worn in the vicinity of the defects, and expensive repairs will eventually be necessary.

Not infrequently weak spots develop in broken stone or gravel foundations, owing to surface water finding its way through joints in the pavement which have not been properly filled with grout. Careful observation of the joints should therefore constitute a part of the early maintenance work, and any defective joints discovered should be immediately remedied. Where the foundation is constructed of concrete, however, slight defects in the joints seldom result in any very serious damage.

If care is exercised to correct all defects which appear within the first few years of the life of a well-constructed brick pavement, the work of maintaining the pavement proper should thereafter, except for cleaning, be almost negligible for a considerable period. The shoulders and drainage structures, of course, need occasional attention, just as in the case of any other pavement, but if they are properly constructed at the start repairs will usually be very slight.

The life of a well-constructed brick pavement can not be estimated with any great degree of exactness, first, because the traffic conditions are constantly changing, and, second, because no brick pavement which has been constructed in accordance with the best modern practice has yet worn out. Such measurements as have been made of the amounts of wear sustained by given pavements during comparatively long periods of years have not been sufficient to warrant any very definite conclusions as to the probable terms of service, though they indicate that good paving brick wear very slowly under ordinary traffic. It is evident that in order to secure the full benefit of this excellent resistance to wear the surface of the pavement must not be permitted to become uneven because of the failure of a brick here and there.

Conclusion

Before concluding this discussion of brick pavements, it would seem desirable to emphasize the importance of proper engineering supervision. In the past many communities have expended large sums in efforts to improve their public highways without first having secured the services of some one competent to plan and direct the work. The results have usually been very unsatisfactory under such circumstances and have frequently served to discourage further effort. One of the mistakes most commonly observed consists in constructing some expensive type of pavement on a road where the location is faulty or the grades are impracticable. Not infrequently sharp angles in the alignment or abrupt changes in the grade, which might be easily and inexpensively remedied by an experienced engineer, are left to impede traffic throughout the life of a costly and perhaps durable pavement.

Even in constructing common earth roads it is doubtful economy to dispense with the services of a competent engineer, and if any considerable quantity of work is to be done, such services should certainly be secured. Since brick pavements are probably more expensive to construct than any other type of pavement at present used for country roads, it is all the more important that their construction should be carefully planned and well executed.

In a number of English towns and cities, large mirrors have been erected at important road intersections to enable drivers of motor cars approaching the junction to see whether a car is approaching the corner on the other road. A recent United States Consular report quotes the "Times of India" as stating that the municipality of Bombay will erect a mirror 10 ft. long and 3 ft. high, at a dangerous street intersection in Bombay. The use of mirrors for thesame purpose is also reported at Glencoe, Ill., where a mirror 8 ft. long and 6 ft. high has been placed at the intersection of two much-used streets. The idea is a simple one and may be worth extensive adoption. Probably it would be necessary to provide for the systematic cleaning of such mirrors if erected, however. One at a much-used road intersection, exposed to the dust and weather, might soon become so obscured as to give no clear indication, in which event it might be a source of danger rather than of safety.

The Quantity System of Estimating

THE American Institute of Quantity Surveyors calls attention to the rank uncertainty of the present method of estimating, which continues to occupy the attention of the architectural and building fraternity, and of those owners who do not seek to beat the contractor and material men. It seems difficult to demonstrate to some owners how a straight and accurate bill of quantities to estimate upon helps them to get better work, a square deal and a satisfied contractor.

It is the experience of those who have long been engaged in the practical advocacy of the quantity system in this country to find that, although the average owner will strenuously deny trying to get "something for nothing" out of a contractor, they, for the most part, really do this very thing. They will hire a certain type of architect, not altogether for his talent as an artist, but for the purpose of helping them get the best of the contractor. This is attempted robbery, from whichever way we may look at it. Can we wonder if, in self-protection, the contractor retaliates?

Such owners appear to argue in their own minds something like this: I (the owner) know something of the building business, and doubt if this contractor fellow knows enough to get ahead of me and my architect, and he surely will not think to keep a few cards up his sleeve?

But even supposing by chance my tricks are trumped too often and I am likely to lose! Is not the referee under the contract in my employ? What do I pay him for? He must protect me, for am I not the owner? I must not let my adversary win, notwithstanding his money is invested in my building and regardless of his practical knowledge, which must also be used to my advantage. Besides, I do not have to play the game every day. The next time I do I will look for a different man, one belonging to my fraternity, one just starting in business and anxious to please preferred.

And this is how the building game is too often played. Common custom and convention compels a certain type among the unprivileged class of architects (those who are not altogether financially independent of clients) to follow those methods which lead to possible future business. That is but human nature, and the human element of self-interest is more often than not apparent.

But if a clear, detailed bill of quantities is once made the basis of the contract—i.e., so much labor and material for so much money and no more (and no less) —then it will help to relieve the other and better type of architects, who do try to be fair to both contractor and owner, from embarrassing positions and decisions, and from otherwise acting in judicial capacities under building contracts, which often accounts for the loss to them of business friends and ultimate loss of professional practice.

Prize-Winning Design for Power Station on the Winnipeg River

REPRODUCED herewith is the winning design for a power developing station at Du Bonnet Falls, on the Winnipeg River. The design, of which Mr. Harold R. Watson, of Toronto, is the author, was awarded First Prize in a competition conducted by the Department of Architecture of the University of Toronto. It is understood that Mr. Watson's design will be adopted by the Government.

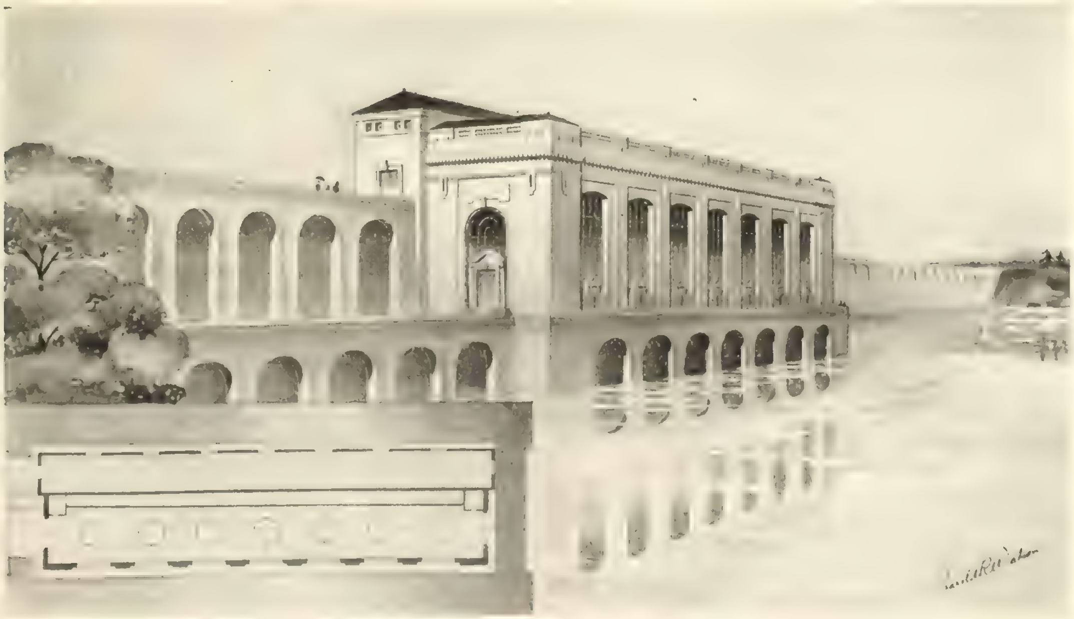
Mr. Harold R. Watson, of Toronto, whose design is reproduced below.

The proposed building will be 80 x 312 feet. The site at Du Bonnet Falls was chosen after a careful survey of the Winnipeg River, which at this point has a drop of some sixty feet, and affords an opportunity for a lock connecting the two levels of the river, and making it navigable for large boats. The building is to be constructed of reinforced concrete and steel. It will contain seven units on 41-ft. centres ,as shown in the block plan to the left of the illustration. An additional seven units are to be added later, thus making the structure over 600 feet long. The design calls for two reinforced concrete bridges to connect the building with the mainland.

The illustration gives a good idea of the character of the building and of the immense scale of its side bays, each of which is 25 feet wide and 40 feet high, constructed of steel sash. The building will be roofed in red tile.

Mr. Watson received his early education at the Technical School, Toronto, from which he graduated in 1913, entering the Department of Architecture in the University of Toronto with Class '17. He has had considerable experience, having been on the staff of the Technical School for two seasons. Mr. Watson intends to specialize in architectural design.

Considerable interest has prevailed in England for some time over the suggestion of using rubber for street pavements. Trial sections of such pavement were laid in the Old Kend Road, in London, some time ago, as this street carries some of the heaviest traffic of the city; and recently a specimen of this pavement was exhibited. The wood block pavement adjoining had worn down from an eighth to a quarter of an inch, but in the same time the rubber-capped wood blocks appeared as good as new; and it would appear from these tests that rubber pavements would be so durable as to make them an economic investment.



Prize-winning design for power station. By Harold R. Watson.

Essential Requirements in Concrete Pavements

IN the laboratory, much care is taken to conserve every value that is placed in a concrete specimen. Many contractors are inclined to feel that when they have stood watch and fulfilled the task of assembling material, mixing and placing concrete, they have finished. This is far from the fact. This work is only the beginning of a concrete operation; conditions are made favorable for the real agent, the silent worker "chemical action," which work will be complete in proportion to the manner in which they have done their part.

This discussion will be limited to concrete when used for street or road pavement, and it is desired to call attention to what have been found to be small and often neglected but important points. The following are most often underestimated, and if there is failure, it can be traced to the neglect of one of these: density, contraction, sub-grade, protection.

Density

Notwithstanding there is much importance in the well-known theme of gradation of aggregate, this is not the most important. Care must be taken in placing and the use of the proper amount of water. It is not difficult to calculate and prepare the mixture that will contain the least voids. On the other hand, it is just as easily shown that this perfectly balanced mixture can be made to contain maximum voids, simply by adding surplus water. Water gauging is too imperfect; slight variations in size of batch, in combination with the hit and miss mechanism of water gauges, are sufficient to produce a different amount of water for almost every batch, notwithstanding the importance of this feature.

For example: If a specimen be taken from a properly mixed and gauged mixture, and 4 per cent. water added to batch and another specimen made, it will be found that the latter will contain much greater voids by reason of its agreeable consistency to catch and hold in its mass small air bubbles, along with water globules from clarification. Most of such additional voids will not be shown by absorption tests, and can only be closely approximated by weight.

To illustrate: Take some soap bubbles and enclose them in a most granular mass, and offer agitation or compression, the dissipation is complete; then place some in the interior of a mass, the consistence of thin-pour, and try to remove them by tamping or compression. It will be found the seasoned specimen will contain them just the same, and though they may be broken up into smaller cells, their full volume will remain in the mass.

The voids created by the addition of surplus water is not the only nor the principal damage done by reason of this excess water. Perhaps a greater damage is done by carrying with it, in suspension, particles of cement flour so important in the hardening process of other portions of the mass, which upon evaporation develop a lining to the cells almost impervious to moisture in an absorption tests.

There are very many things depending upon conditions when chemical action begins to take place in a mass of concrete. If the mass is highly porous, from excess of water, the crystals will be largely of needleshape, with hexagonal plates in the matrix films. If the mass is more dense, hexagonal plates and crystals will abound, and if the mass is of high density the bond will be hexagonal crystals planted in colloidal films. This last condition cannot exist if too much water is used in the mixture, unless much effort is used in tamping, or until an osmotic state is established in the mass.

The proper amount of water is the amount nearest to, without developing, clarification, and will vary with absorbing capacity of ingredients. Water-tamped should not be used for street pavement.

Contraction

Expansion is neglible if contraction be properly provided for, since expansion comes from only one cause, that of rise of temperature (and absorption in porous concrete, which should not be used in pavement), while contraction comes from several causes, some of which begin to operate almost immediately after the concrete is put in place, as follows:

(a) Settlement during moments of clarification(if such) which may lessen stress between solids.

(b) Shrinkage during drainage period (if any) which may open lines for percolation.

(c)Shrinkage after initial set has taken place. This form of contraction is probably the most damaging to concrete and is greatest in porous concretes, doing damage in the form of unseen cracks that develop later, leading one to mistake them for those of more recent origin.

(d) Crystallization.—Crystal and colloidal bonds like many other formations grow less as they grow older and stronger. This is another form of contraction that goes on for several months; in connection with this it will be understood that where moisture remains in the mass, these bonds may grow stronger without losing in size, and in the end will make a stronger bond.

It, therefore, becomes important that as much as possible of the original moisture be kept in the mass and as long as possible. Water sprinkled upon the surface of a too rapidly drying pavement will not answer, as such water vaporizes and rises in the air. More concrete is permanently damaged by this form of contraction by shrinkage, caused by too quick drying-out, and the cutting short of the hydration of the elements, than from poor material and mix.

Sub-grade

It is seldom that an engineer objects to the amount of rolling of sub-grade, except to get as much as possible, claiming it is impossible to get too much.

More pavement is damaged by over-compression of the sub-grade than by under-filling. If a sample of earth be removed and subjected to great pressure and again placed in the earth and after a time be excavated, it will be found that this sample has restored itself to the natural density, or at least to that of the earth surrounding it. Uneven compression of the sub-base is responsible for much damage, commonly called "buckling of pavement" at center or quarter. It is seldom an action of the pavement, but is caused by a raising up of pavement at points where over-compression exists in the sub-soil. The over-compression is highest at the center, since this is the easiest place to operate the roller, there being less liability of getting into the curb and gutter in the case of streets, and off in the ditch in the case of roads. Transverse cracks are often started by some form of shrinkage and extend when the sub-grade brings the restitution of its volume back to nature.

All clays are highly compressible—some of those on which tests were made restored themselves in one year, some in two, others in three or more, but all of them reverted to their natural volume in due course of time.

Where a soil is easily compressed, this should be done with caution, and in the reverse case, it usually gets little compression.

Protection

Concrete may be able to carry a great load at the age of one month, but will not resist the abrasive action of traffic. When one stone is displaced, the impact is multiplied upon its neighbor. Surface stones should be protected from actual contact with abrasion of traffic for a period of some months.

This is made practical by the placing of a surface coating in the right manner at the right time, and is well worth the small cost.

Maintenance

Slight variations in the grade of any pavement should receive immediate attention, as small defects will in a short time develop great damage.

Load Tests on Brick Piers

At a recent meeting of the National Brick Manufacturers' Association an interesting paper based on an investigation now being conducted in Pittsburgh by the U. S. Bureau of Standards, in order to determine the physical properties of large piers when tested to destruction, was presented by Messrs. J. H. Griffith and J. G. Bragg, members of the staff of the Bureau. It is of interest to mention that Prof. A. V. Bleininger, the well-known ceramic chemist, who has addressed several meetings of brickmakers in Canada, acted in an advisory capacity throughout the investigation.

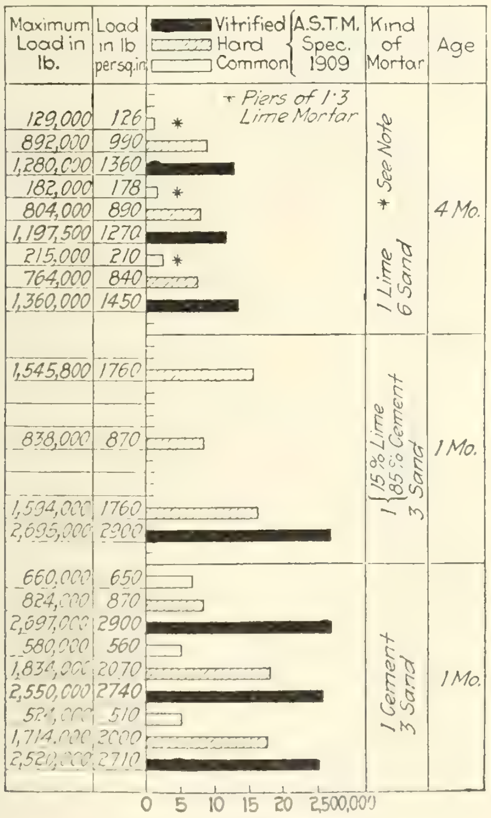


Fig. 1.—Data of load tests.

So far, more than twenty-two piers have been tested.

As nearly as possible each pier was 30 in. square by ft. high, except two piers which were built 5 ft. high. Each pier averaged 44 courses. The joints were about 5/16 in. thick. The qualities of brick used, kinds of mortar, ages of piers and results of tests are tabulated in Fig. 1. Three typical styles of bonding were selected for test—header every other course, every fourth course and every seventh course; thus there were three types of bonding for each set of piers. One of the 5-ft. piers had steel-mesh reinforcing placed in every horizontal joint; the other, every four courses; but the results obtained were inconclusive (see Conclusion No. 7).

Method of Test

Each pier was constructed in the laboratory on a steel plate 1 in. thick, leveled on the floor. The plate surface which was to rest on the base of the testing machine was planed. A plate 1½ in. thick, with eyebolts for crane connections, was laid on the top of the finished pier, connected with the baseplate by four vertical rods, so that the piers could be filled easily and set in the testing machine without injury. The top plate was removed after the pier was in place. The pier was leveled, the top covered with a thin coat of plaster of paris, and the head of the machine brought down, squeezing out superfluous material. The pier was then left for several hours to allow the plaster to set. Measurements of compression were made at several corners, as were also transverse measurements and strains between bricks.

As shown in Fig. 1, bricks laid up in cement mortar stood up best. Cement-lime mortar gave almost as good results. Piers using lime mortar were only about one-half as strong as those with cement; but it should be noted that vitrified brick laid up in lime mortar withstood a pressure of more than 1,400 lb. per sq. in. The weakness of these piers was caused mainly by an almost entire lack of carbonation of the mortar on the interior, rather than by a special efficiency of lime mortar when properly aged.

Characteristic Failure of Piers

At about three-fourths maximum load vertical hair-cracks began to appear. With continued loading the piers broke up into vertical laminations. This condition was induced by the bending of the individual bricks, causing them to split transversely. The bending is the result of non-uniform bearing proceeding from lack of homogeneity of texture in the pier, in an individual brick or in the mortars.

The progressive action of this cracking is most interesting. Sometimes very early in the test small haircracks formed in the upper or lower surface of a brick, usually just under or near the vertical joints, and widened at the surface as the load increased. Finally, subdued sounds were heard, which increased in volume until, in the case of vitrified and hard-burned brick laid up in lime mortar, a succession of popping sounds occurred, frequently increasing until the sound became a loud "bubbling" in the final stages. When a brick split, the ones above and below tended to do the same, until the structure became a succession of strips, and failed either by spalling out in large masses or as a group of thin, isolated columns.

The following are the main conclusions reached in the investigation:

(1) The strength of piers under vertical loading bears a close relation to the kind of brick used and the quality and age of the mortar.

(2) The low strength of piers laid in lime mortar is

attributed in the main to insufficient aging, with a consequent lack of a proper carbonation of the mortar.

(3) Experiments seem to indicate that the strength of a pier is largely independent of the course bonding. The real function of bonds is to maintain a certain integrity and monolithic action of the masonry against initial strains induced through setting and "drying out" of the mortar rather than to give any great increase of vertical strength.

(4) The elastic limit of the piers laid up in cement and cement lime mortar was approximately one-half the maximum load.

(5) Piers fail through a tendency to separate into vertical strips caused by bending failure in the individual brick produced by unequal distribution of the vertical load over the cross-section. This is aggravated by ineffective shearing and adhesive strength of the mortar.

(6) A high modulus of rupture of the brick is more desirable than superior crushing strength. Higher modulus of rupture would be realized in practice by increasing the thickness of the bricks or by laying them on edge.

(7) A further study of the action of steel-mesh reinforcing in the horizontal joints is recommended in order to ascertain the load efficiency of piers having an outer shell of hard brick with an inner core of softer brick. This construction would be used where a high-grade brick is not easily obtainable.

The Construction of Concrete Houses

OWING to the increased use of concrete in industrial and business buildings, remarkable developments have taken place in this branch of the industry, though until recently little advance has been made in the class of buildings of residential character. Dampness is the principal objection to concrete construction. It is easy to see that if a solid wall thoroughly chilled has warm air suddenly impigned upon it, the moisture in the air will be condensed as with an ice water pitcher on a warm day. Now ordinary, monolithic concrete of a fairly rich mixture is practically waterproof. The condensed water is not readily absorbed by the wall—hence the damp condition that follows. Brick, tile, and many other materials are absorbers of water to a certain degree; wood, to a large degree.

It is quite clear, then, that if we want to eliminate dampness due to sweating, we must approximate the conditions of such materials as do not sweat, and a construction that cannot be damp under any conditions.

Various Types

To begin with, there is the typical wet mix. Here the water practically carries the cement in saturated solution to all surfaces of the aggregate and deposits it there, enough mixing and churning being given to distribute the cement-saturated water evenly. This type has many advantages as to ultimate strength and waterproof qualities, and is widely specified, but it is not adapted to residence work, either as a final material or as an economy proposition.

At the other extreme is the typical dry mix (used fifteen years ago in foundations and to some extent in the concrete block industry today). This type, on account of excessive porosity and the great amount of tamping or pressure needed, is equally unfitted for residences. Midway in the scale, however, is another kind of concrete that has some remarkable properties—which are just what the house builder is after.

Voids Wanted

This mix should have primarily an excess of the medium-sized aggregate and sand. That is, we want voids, but we want them very, very small and not connected, so to speak. In other words, we want to approximate the structure of wood or brick, not the closeness and homogeneity of steel. It should be wet and plastic like mud, but with no surplus of water, and requires mixing for a comparatively long time. Finally, it should be rapidly cured or dried out by removing the forms as soon as possible.

The qualities of this product are peculiar. It will absorb water to a moderate amount without being subject to leakage, and attains considerable tensile strength while still green; also it does not exert much pressure when setting, and is not nearly so subject to expansion and contraction as a wet mix. Cracks will often reknit twenty-four hours after final set, on application of pressure. Frequently scrapings from a wall two days old catch on the wall below and set up again, adhering so firmly that a cold chisel is required to dislodge them. Further, such a mix when cast in wall form is strong enough to hold four feet of concrete above without side support, and yet is soft enough to cut like cheese at the bottom, and is an ideal material for certain purposes.

But what we started after was, to begin with, a material approximating brick and wood, with little tendency to sweat—and finally a construction that would nullify whatever tendency there was. The last requirement is met by the double wall—that is, two concrete walls, with an air-space between. To carry this construction through, however, economically and structurally, several serious difficulties had to be overcome.

Problems to Be Solved

First,—some practical construction method was needed to transmit and equalize the weights coming on the inner and outer wall. Obviously, two thin slabs stuck up on edge, one slab taking all the floor weights and the other only its own weight and part of the foot and tied together merely at intervals by through ties at right angles to walls, was not altogether satisfactory, unless each wall was over thick; also comparatively thin slabs of any length or height are particularly subject to temperature shrinkage and resultant cracking, thus requiring much reinforcing steel.

Second,—a double-wall construction calling for the use of core forms presents the item of considerable expense, and many practical difficulties arise if a standard construction is use. Again, the ordinary form methods are practically out of the question, due to certain special conditions peculiar to house building, viz., number and variety of openings, irregularity of walls, necessity of placing beams without waiting a long time, or the great number and variety of chases, plugs, or openings to be anticipated.

Third,—in a general way, the point of economy so governs the whole question of residence work that unless it can be shown clearly that concrete is at least as

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* From a paper read at the first annual convention of the American Society of Engineers, Architects and Contractors.

cheap as other masonry construction, it is idle to consider whether or not it is satisfactory as a whole.

Concrete construction has grown along certain definite lines, the general experience being that forms and form work are comparatively expensive, but that the mixing and placing can be done quite cheaply by machinery, mixer, and chutes, provided there is enough cubic yardage to pay the cost of installing the plant and running the system. This is based on the use of a very wet liquid mix, as this is the only kind that will flow readily. So that, to a very great extent, working along these lines, all endeavor has gone into cheapening the handling end; very little, until recently, into investigating conditions of the mix or improving the forms. This, of course, is largely due to the ease of handling a wet mix, and the fact that if enough storeys are to be cast in a high building the initial cost of the forming is divided sufficiently often to bring out a very reasonable total.

But in the smaller type of building and residence, we have an entirely different proposition. The wet mix is not a satisfactory material; the yardage will not justify an elaborate handling plant; and the forming cannot be standardized upward.

The savings here must be made in another way, by the method and form themselves, in cutting down the labor of setting them up and taking down, in eliminating to a great extent the cost of shifting, in providing an automatic plumb and alignment scheme that is independent of care and trade skill, and lastly, in using standard forms in big units that can be used on any and all buildings, irrespective of varying wall lengths—and all this with little or no depreciation of forms and equipment. This can be accomplished by a scheme of standardization longitudinally. Previously the small cast concrete building had apparently been conceived entirely as a monolith, somewhat as the first sidewalks were made, without joints.

The introduction of a separately built joint member in connection with cast walls and girders made possible the satisfying of the various form criterions noted above, and also did away with the structural difficulties previously mentioned as connected with the double wall.

In a concrete residence on Long Island, the walls of which were recently completed by this method, the entire cost of cellar and walls, including setting and shifting forms and depreciation, averaged $5.50 a cubic yard. There were 385 cubic yards in the entire building. The dimensions of the building were 62 ft. 6 in. by 41 ft. 6 in. by 23 ft. 6 in. from first-floor beams to roof plate. The approximate time of erection above first-floor beams was fourteen working days.

As the walls largely consisted of two 4-inch slabs, each square foot of wall surface represented the equivalent of two-thirds of a cubic foot, which gave a cost per square foot of wall surface of 14 cents. The conveying apparatus used consisted of a 5-cu. ft. mixer, with hoist and bucket dumping into a very short, steep chute, which in turn emptied into wheelbarrows. No scaffolding whatever was erected, runways over horses and on second floor beams being substituted.

There is one other factor in the general problem, namely, the overhead cost of concrete work. The tendency has been in the building art to develop concrete work as a thing apart for large buildings and structures requiring great strength. Architects and engineers have become accustomed to use a standard form of specification whose requirements, if lived up to, furnished a product suitable to heavy structures, and little else. To require an ultimate strength of 2,500 pounds to the square inch where the maximum strain would never be 25, is certainly keeping on the safe side, but obviously a little absurd and very uneconomical.

The result has been that (1) in small work the requirements have not been lived up to, a practice which has been more or less condoned by architects on account of the high factor of safety; and (2), the segregation of the skilled concrete workers into a class employed entirely on big work.

But concrete is rapidly coming in as a universal building material; and, with the enormous demand for cement and gravel, we shall find it inexpedient to be wasteful with it, either directly or indirectly, and there will soon be a real demand for skill in its use as a plastic building material, which will automatically remedy the present condition.

Public Speaking for Engineers

FROM experience with several hundred young and middle-aged engineers, writes F. H. Newell in the course of a recent letter to The Engineering News, I may safely assert that there is not one out of ten, or possibly one out of a hundred, who has shown the ability to write the story of an important public work in such a way as to be readable by the public. It seems as though all natural ability in expression had been destroyed by the educational methods or the technical training. For example, a young engineer writing home to his family gives a most fascinating account of his work; but ask him to write out the larger facts for publication and he immediately begins a cramped, dull description of relatively unimportant details or technicalities concerning which few people care to read. He seems to lose his sense of proportion or his perspective. He is unable to adjust his mental attitude if he is conscious that the material he is writing is to be read by any one except his favored correspondent.

Successful engineers must be men of imagination, men who can picture in their own minds the great possibilities latent in unattractive surroundings. This imagination so necessary for success is often unavailable as far as giving information to the public is concerned. The preservation of the freshness of statement and clearness of vision are among the important things which seem to be lost by the time a young engineer has achieved success in other lines.

It is of the highest importance, not merely to the engineering profession, but to the public in general, that we endeavor to bring forward systematically the man who can and will write out short interesting descriptions of engineering works and achievements. Each engineering society should regard it as a duty to the public and to the profession to find among its members the man who can do this and to encourage him in every possible way to aid in the diffusion of correct information and in the education of the local public, not through technical journals, which the public does not read, but through the daily newspapers and the Sunday editions which come into millions of homes.

Granite or limestone masonry, well dressed, weighs 165 lbs. per cubic foot; mortar rubble eighs 154 lbs., dry rubble 138 lbs., and well dressed sandstone masonry 144 lbs.

The Science of Cost Keeping and Management

By F. A. Barnes*

THERE are, as you all know, two general methods of carrying on work, viz., by contract and by day labor. The engineer designs and lays out the work in both instances, but in the first case his supervision of actual performance is limited to the enforcement of the contract and specifications, while in the second he has direct charge. Theoretically, therefore, the second method saves the contractor's profit and should be the more economical, but, in practice, human nature must be taken into account and we find that the engineer, even though he be as competent as the contractor, is usually not as efficient, probably because he is spending the money of others, while the contractor is practically spending his own, or, at least, is directly interested in having as much as possible left for profit. The truth of the above statement is generally admitted and was recognized by the court in the case of O'Brien vs. Mayor of New York, when it said in its decision: "There is no spur like self-interest in business enterprises, and it may be regarded as certain that the contractor will always take care of his own interest so far as possible. This is natural and proper, and no fault can be or is found with such a fact. But how far the officers or employees who represent the general public or the corporation which is building the work can be depended upon for steady, earnest, zealous, and able attention to the public interest is always a matter, to say the least, of some doubt." A careful analysis of the costs in cases where good showings are claimed to have been made with day labor often reveals the fact that some charges, such as plant repairs and depreciation or overhead expenses, have been omitted entirely from consideration.

Of course, under the day labor system, the party having the work done has better control of it and can more easily make changes as the job progresses, especially as compared with the ordinary lump-sum contract; but his risks are increased, even though liability for accidents to employees and the public is covered by insurance, as is now usually the case. It is principally, however, because contract work is usually cheaper, as pointed out in the preceding paragraph, that most highway work is now and probably will continue to be done under the contract system, and this fact may lead some of you to wonder if it is worth while for the engineer to interest himself in cost keeping and management. In my opinion, this query should bring forth a most emphatic answer in the affirmative, for the following reasons:

Importance of Careful Analysis

In the first place, a careful analysis of the job and the method of performing it, which is essential to effective cost keeping, increases one's knowledge of construction work and is of benefit whether one considers costs or not, but, unfortunately, is not likely to be undertaken unless they are considered. Costs of the component parts of the work and of methods of performing them should always be considered together, however, as such investigation will frequently lead to the adoption of changes in plans or methods, or both —such as changes required to adapt the work to the use of labor-saving machinery, etc. Such investigation would also increase the ability of engineers to make accurate estimates, something which would do much to enhance the reputation of our profession. As to management, its laws apply in considerable measure to all human relations, such as those between contractor and engineer, and completely to relations with subordinates; and no one can reasonably expect to rise to the higher and more lucrative executive positions without some knowledge of such matters. Hence it is my firm belief that a study of cost keeping and management adds to one's value to his employer and to the public by increasing his ability to design economic works and to erect the same at minimum cost, and that such study is absolutely essential if engineering is to justify the definition sometimes given it— "The art of making a dollar earn the most interest."

Cost Keeping Defined

The first topic which I shall take up is cost keeping, which has been roughly defined as the process of determining where your money goes and what you get for it. That is, it involves the determination of output as well as of costs. Even this rough definition is too precise to cover the practice of a contractor whose testimony I heard in a case in New York City some years ago. He explained that he kept no books. If there was anything left at the end of the job, he put it in the bank; if there was a loss, he drew a cheque for it. Such methods can flourish, of course, only in fields where abnormal profits usually obtain, and are rapidly disappearing. Increasing competition has forced contractors to keep accurate costs, primarily for the purpose of securing high efficiency and hence low costs so as to be able to bid low and secure work to do, and also because of the necessity of knowing costs more accurately when bidding closely in order to avoid loss. That is, the two principal purposes of cost keeping are:

(1) To measure and increase efficiency.

(2) To secure data for making estimates.

To accomplish these purposes, all the factors of cost, viz., labor, materials, plant charges, supplies and overhead expenses, must be considered, and such matters as excessive use of materials or supplies, inefficiency of labor or supervision, lost time due to breakdowns or lack of co-ordination, and irregularities due to dishonesty (padded pay rolls) or carelessness show up at once in the data obtained and may be corrected immediately. The cost of supervision can be reduced quite frequently since the report card with its accurate data on output is a better spur than the presence of a foreman who has to judge from appearance only. Cost keeping furnishes accurate data upon which to base changes in plant layout or design and for testing the efficiency of new machines and also naturally leads to the adoption of some system of wage payment which takes into account the efficiency of the employee.

Concerning Forms

I have not taken the trouble to prepare any forms to show you, as they are rather hard to grasp in the limited time available, and the design of forms constitutes an important part of the training of the "analysis man" or cost keeper. One who slavishly copies forms devised by others not only misses this training, but will probably use forms not entirely adapted to his own work, and; even if they are suitable, will not use them as intelligently as if he had devised them himself. It has been said that anyone can devise forms once he knows exactly the data he wishes to secure and hence it will be best to devote our attention to the principles involved rather than to specific examples. A study of existing forms, especially after one has had some experience, has, of course, great value, and the beginner can thus quickly acquire a knowledge of the various space-saving schemes for use where the desired data are very numerous. These schemes may easily be picked up in the technical press.

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Probably the most diffifficult part of cost keeping is to determine upon the data to be secured, that is, along what lines and how far shall we carry our subdivision of the work? The tendency of beginners is to subdivide too finely, thus materially increasing the cost of securing the data and producing results of no particular value. Hence we should not only keep in mind constantly the two principal purposes of cost keeping, efficiency and estimates, but should carefully weigh the value of each item and satisfy ourselves that data upon it will be worth while before attempting to secure them. In concrete work, for example, it is manifestly futile to attempt to secure data on costs of the various operations involved in cases where the same men are used for all of them and consequently are continually shifting from one to the other.

Classification and Correction of Data

In determining upon the classification, the items of work given in the contract and upon which unit prices may be given, furnish a good starting point and usually form the basis for the primary subdivision. These items are then subdivided in accordance with the operations involved, particularly if different men or different gangs handle the various operations, and their output must be determined in units other than those of the principal items in order to measure their efficiency. In rock excavation, for instance, the efficiency of the drilling gang depends on the number of lineal feet of hole drilled rather than on the number of cubic yards of rock removed. The above considerations or the desirability of co-ordinating the outfit and men, or classes of labor used in a single operation may lead to its subdivision on one of these bases. For example, form work in concrete construction involves the use of carpenters and helpers and the proportion of cost chargeable to each should be determined so that the most economical arrangement may be found. The application of this same principle to the main items, or to the entire job, leads to the discovery of excessive use of materials or supplies, or that cost of supervision is an excessive percentage of the total, etc.

In addition to the determination of the data to be secured and, in fact, during its determination, attention must also be given to the organization to be used in carrying out the work, especially as it affects the method of securing the data, which in turn affects the design of forms. Where the work is concentrated the timekeeper may be charged with the duty of securing data on both output and costs, though he must depend upon the foreman for information as to the times when the shifts in the gangs are made unless he is on the work continuously. Hence it will frequently be best for the foreman to be held directly responsible for such data, his results being checked roughly by information secured by the timekeeper who visits the work at regular intervals. This latter method is necessary in case the work is spread over large areas or considerable distances. In some cases, especially on piece-work, performed by skilled laborers, data on output are most easily secured by having the individual workmen make the original record. This often increases their interest in the work, and takes little time or attention, involving merely counting the pieces of finished work or punching a tally card as each piece is completed.

On other work output is usually more difficult to determine, involving measurement of lengths, areas, or volumes, but with the aid of the engineer's station marks, lengths are easily found and frequently areas and volumes are direct functions of the length and may be computed in the office. Sometimes volumes are determined from the number of loads handled, but care must be taken to secure fairly uniform loading and to use a proper allowance for change in volume of the material. Again, so-called functional units are used, as in estimating the number of cubic yards of concrete laid in a day from the number of bags or barrels of cement used, etc. The two methods last given, or in fact any approximate method, should be checked by actual measurement at frequent intervals, but cases are rare where complicated measurements are necessary daily. Quantities of materials and supplies used are similarly treated.

Utilizing the Data

Having now determined upon the data to be secured in addition to the pay roll data and the method of securing them, units to be used, etc., the designer of forms must finally consider the accounting system or method of working up the data and utilizing them, as the forms must give the data in shape for immediate and convenient use. Many organizations spend considerable money on the collection of data, but fail to work them up in time to be of service. Simplicity and accuracy should be the keynotes of both cost keeping and accounting systems which should fit into each other. In general, the field records should be favored in the matter of simplicity and all computations and combining of reports should be done in the office. Forms may be simplified, of course, by requiring a number of different men to report and each man's interest may be enhanced thereby, but filling out even a simple report takes time and attention which might often better be devoted strictly to the work and hence I believe the tendency to make the timekeeper responsible for most of the reporting to be a salutary one. The accuracy of reports may sometimes be checked by requiring two men to report on the same thing and it is always roughly apparent from the results secured.

It is, of course, not essential that actual costs be used in studying efficiency, in fact, costs in man-days, machine-days, or in dollars and cents on the basis of assumed standard prices must be used in comparing the results on different jobs, and even then one must be sure that the conditions are similar before jumping at conclusions of relative efficiency. The same methods apply to the combinations of the elements of cost necessary to make up an estimate, that is, since we have amounts of labor, supplies and materials, plant charges, etc., in detail for each part of the operations making up the main contract items, we may apply any prices, we choose. It is only in this way that an accurate estimate for a particular case may be obtained. I believe, however, that the accuracy of estimates would be increased by alloting more items and by avoiding the common tendency to throw all supervision and even plant and tool charges into general expenses. Supervision exercised by foreman and even by the contractor himself could frequently be allotted to the various items of work, and there is no reason why the cost of a shovel exclusively used for concrete work should appear in the general charge account. In order to obtain true costs, every possible element should be included in the cost of the item and as little as possible left for overhead or general charges.

Allowance for Depreciation of Plant

An item particularly difficult to determine is the proper allowance for depreciation of plant, also whether heavy repairs should be charged against the job on which they are made even though the necessity for them was largely due to previous work and their benefits extend to subsequent jobs. There are many methods of handling these questions, but I believe the most accurate one is to make an appraisal of the plant at the beginning of the work and as often thereafter as may be necessary for cost keeping purposes. This appraisal should be made by an expert in plant values and the value assigned should be the estimated value, f.o.b. at the nearest probable market.

In connection with the use of costs, the cost chart or graph of unit costs is very valuable as it shows at a glance just how the costs are running; it may also serve to check up the reports due each day if a curve is plotted for each report. Another most useful device is the progress chart, on which a schedule of the work, or items thereof, is laid off with corresponding quantities, percentages, and prices. As the work progresses, actual dates, quantities, percentages, and prices are also plotted so that one has a direct comparison of actual results with the estimate and can predict the probable outcome of the job at any time. I wish to emphasize again the necessity of keeping all these records strictly up to date; it is of no value to find that costs are running high unless it is discovered immediately and the remedy applied before the job has long continued in an inefficient way. There are other minor records, such as the foreman's diary, history and sketches of the work, etc., which should always be included with cost data so that the exact conditions under which the costs were obtained may be known.

The Art of Management

Now taking up the subject of management, I fully agree with Mr. Moore that there are no ten, twelve or twenty principles involved and the management is and always will be an art rather than a science, but many of the principles which have been put forth during the last few years are of value to those who desire to make progress in this art. In my opinion the most important of all these principles is what Mr. Harrington Emerson calls the "Fair Deal" in his book on the Twelve Principles of Efficiency. In fact, I believe it essential that the spirit of fairness permeate every thought and action of the manager if he would be most successful, and the man who takes up a study of management with the sole purpose of getting more work out of his men without giving them and benefit in return defeats his own purpose. Spying upon men to determine whether they are doing good work or not is, I believe, incompatible with the spirit of fairness. Men will work and work hard for the "boss" who is square with them, not, of course, in entire disregard of other factors, but sometimes nearly so.

Next to fairness, in its effect at least, I would put what is sometimes called the law of proportionate reward; that is, pay should vary with output. Strictly interpreted, this means payment for services on a piece-rate basis, which is practically impossible in most civil engineering construction and which has been abandoned by many of our best industrial concerns (where it may be more easily applied). The piece-rate system leads to excessive speeding up and inferior output and does not identify the interests of employer and employee as is attempted by some of the later bonus systems. Bonus systems, especially for gangs, could be applied in civil engineering construction more often than they are and no doubt would increase efficiency. Coupled with this law of proportionate reward is the rule that the reward should be prompt, especially with the unskilled laborer whose imagination is not usually sufficient to furnish continued incentive to increased effort unless he receives the reward at frequent intervals.

Another law of management is that of the subdivision of duties which means, of course, simply carrying the familiar law of subdivision of labor into the organization. Men have different capacities and abilities and care should be taken to observe these in assigning them to work, since they will not only take greater interest in doing work for which their talents adapt them, but will also accomplish more along those lines. Closely allied to this law is the rule that the planning of work should be divorced from the performance. Much money is lost by throwing the burden of planning the work on the foreman, both because he is often not competent to plan and because his whole attention should be devoted to handling the gang.

The Law of Co-ordination

Then there is the law of co-ordination, which is that each element of plant and each gang should be kept working to its full capacity. That is, they should be properly co-ordinated so that no gang will have to wait for any other gang or machine, or for supplies or materials. The time of arrival of supplies and materials must therefore be properly scheduled and the capacity of elements of the plant and of gangs adapted to the work of the others.

Another law of management, if efficiency is to be measured closely by means of a cost keeping system, is that the men or gangs must work under standard conditions. Obviously, it is unfair to compare outputs unless the conditions under which they were obtained are similar.

The law of educational supervision increases efficiency by standardizing practice and also reduces the amount and cost of supervision. Men can accomplish more if trained to do their work in accordance with a standard method, especially if that method is the result of a study of the best methods of accomplishing the desired results, as it should be. Even an individual can accomplish little if he is continually changing methods, and such practice is much more demoralizing to an organization. The instruction books issued by the State Highway Department furnish examples of the application of this law and the reasons for it are well stated therein. Many of our industrial concerns also have elaborate systems of educational supervision.

Executive and Subordinates

In addition to the above laws of management, the executive should remember that he is employed as a manager to handle the big questions and hence should leave the petty details to his subordinates. A good rule is to never handle matters that a subordinate can handle as well, and in cases of doubt throw the responsibility on the subordinate. This will add to his value and relieve the manager for larger affairs. In other words, trust your subordinates and do not continually interfere with them, but leave them to their own resources and hold them responsible for results. Too many managers think themselves indispensable until an enforced absence opens their eyes to the fact that things get on as well or better in their absence than when they are continually present. Another fact to remember is that too close contact with a job frequently causes one to lose his perspective and very often the man who visits the work only occasionally is able to point out defects which have entirely escaped the attention of the man who "lives" on the job. This is the service you should render your subordinates and you are more likely to be able to render it if you hold yourself aloof from the petty details of the work. Furthermore, always respect the authority of your superintendents and foremen and never go "over their heads" and deal directly with their subordinates; nothing will so quickly destroy discipline.

The above are the principal laws of management, but the observance of some other rules will assist in securing results at minimum cost. One of these calls for the reduction of the labor element, partly on account of its high cost per unit of work accomplished and partly because of the uncertainty in its price and efficiency. The cost and output of a machine can be determined much more accurately. Hence there is a decided tendency toward the greater use of machinery and new ones are being devised daily, with the result that the labor element in many lines of work is becoming less and less. Machines must be closely watched, however, to avoid loss of time due to break-downs, especially where the operation of the rest of the plant depends on their being kept at work. Parts liable to break should be kept on hand, ready for instant use, and machines should be repaired outside of hours in so far as possible. This scheme was carried out on the Panama Canal where the break-down of a shovel would throw the whole scheme of operation out of gear. Traveling machine-shops, capable of making heavy repairs to shovels, were sent over the work each night and break-downs during working hours were practically unknown. Lost time may also result from lack of co-ordination and classifying the causes often points the way to the remedy.

A consideration of the number of foot-pounds of work involved in an operation, i.e., looking at it from the standpoint of mechanics, would often indicate a way of reducing this work, such as using rollers to move heavy loads, etc. Low-priced men should always be employed to do the manual labor and sufficient helpers should always be supplied to keep skilled men at work on operations involving the use of their skill. Dead loads should be reduced as much as is consistent with safety and may sometimes be balanced by counterweighting.

The ratio of overhead expenses may often be reduced by speeding up the work, or sometimes it will even be desirable to resort to night shifts for this purpose. As a rule, however, direct costs would increase and it would not pay to work night shifts unless the time limit is very short.

Finally, it should be noted that our whole purpose is to make the sum of the elements of cost a minimum and hence we should not allow ourselves to be misled by the contemplation of a single element. An expensive plant would increase the unit cost for plant charges, but would decrease the unit cost for direct charges and might also decrease overhead charges—both directly and by decreasing time of construction. Hence one must work out all the elements of cost for each and compare their sums before deciding the matter. Once it is decided, however, and during construction, every effort should be made to reduce each element of cost, and in this it will be desirable to determine what percentage each element is of the total cost and devote one's attention to the larger elements first, as a proportionate reduction in the smaller items would be much less important.

Effect of Contracts and Specifications

Now just a few words as to the effect of contracts and specifications and the attitude of the engineer on costs, though some good citizens of New York State will deem it entirely unnecessary to advise greater cooperation between engineer and contractor. Contracts originated from the necessity of forcing men to do as they agreed, that is, because some men would not keep their word, means had to be devised of making them do so. I fear some of this old spirit permeates our present contracts and is responsible for some of the unfairness in them. On the other hand, a contract assumes a perfect agreement between the two parties to do or not to do a certain thing, and if that thing is indefinite, how can there be a real meeting of the minds? That the subject matter of many contracts where so much discretion is given the engineer, is indefinite will be granted by any reasonable person. I have not time to give you illustrations—you all know of them. I want to point out, however, the effect of unfair provisions and of arbitrary and unjust action on the part of the engineer upon the cost of contract work by citing the example of government work. Mr. King, of the bar of the Court of Claims, speaking before the Government Contractors' Association, told of being present when settlement was made on a large government contract. The contractor remarked, "The next time I work for the government, I will get higher prices." The engineer officer replied, "It will be ten years before you get any more work from the government." "Why?" asked the contractor. "Well," said the engineer officer, "because it will take about that time before the rest of the contractors realize that they must bid higher prices on government work."

On a government contract, not long ago, there were no bids received while thirty-six contractors bid on a small sewer job at about the same time. And it is true that in certain departments of the government, there are only a few contractors who are willing to put their pocketbooks in the hands of the engineer officers and take chances on having something left when they resume control. So there is no question in my mind but that the contract and specifications and the attitude of the man who enforces them ultimately affect contract prices. Furthermore, I believe the men who write such contracts and specifications or who assume such unfair and arbitrary positions are less competent than those who make poor designs and they certainly waste more of the public money. I do not mean to say, of course, that the engineer should put himself into the hands of the contractor, but there should be a real agreement on a definite proposition and it should be carried out with fairness and justice on the part of both parties. There are sufficient uncertainties in construction work without increasing them unnecessarily and compelling the contractor to also be a gambler.

One other important matter affecting costs is now being considered in this country, and it should receive our aid. I refer to the elimination of the large economic loss involved in having ten or more contractors spend time and money in estimating a job when only one of them can get the work, by having the estimate made once only by a quantity surveyor, who is employed by the owner, just as the engineer is now employed. They have had quantity surveyors in England for years, but we are only just waking up to the saving which could be made in this way.

Damp Walls

THE architect has at times to meet and overcome defects caused by dampness in walls. The first matter is to determine the cause. If this be removed the remaining trouble may be or may not be left to time, and the decorator. If the whole cause of the trouble, says The Salon, be simply moisture, it will dry out after its supply is cut off.

Among the most fertile sources of this simple kind of dampness in walls above ground are faulty roof gutters, leaky water or sewer pipes, and ineffective surface drainage. In rooms below ground surface the trouble may arise from any of the above causes or from subterranean springs or water-bearing earth strata. If practicable the outer face of the wall should be uncovered and a surface damp course laid against the wall, consisting either of some waterproof material, or a belt of broken stone or pebbles, with a properly formed drain at its foot. If this be not practicable it may be necessary to line the wall inside with lath and plaster fixed on battens plugged to the wall. Where it is possible to induce a current of air to pass up between the vertical battens, that is, between the laths and the damp wall, the moisture is to a large extent removed and a fairly satisfactory remedy achieved. Sometimes a layer of rich cement is floated on the inner surface of the wall after the face has been properly prepared.

Sewage used for Flushing

A flush tank system in which the sewage itself is used for flushing was described by Isaac Shone, the inventor of the Shone compressed-air ejector for handling sewage, at the annual meeting of the Institution of Municipal and County Engineers of Great Britain. Mr. Shone, who is nearly eighty years of age, has developed this flush tank system to eliminate the disconnecting trap commonly required in British plumbing practice between the soil pipe system and the public sewer. The flush tank is a closed cast-iron chamber having a capacity of a dozen to twenty gallons. The sewage discharges into it until it is full, when it automatically empties itself by siphon action. Mr. Shone intends this apparatus, according to the description in his paper, for use on combined sewer systems where the rain water from the roofs as well as the house sewage is discharged into the sewer. With the frequent rainfall in the humid climate of England, frequent discharge and consequent flushing of the lateral sewer would be much more effectively secured than would be possible where the separate system of sewage was in use or in a climate where long periods of drought occur.

Stresses in Railway Track

Stresses in railway track under passing trains have been investigated by Mr. J. T. Williams, professor of railway engineering, University of Kansas, and are described in a paper in the "Railway-Age Gazette." The apparatus used consisted of a recording instrument which measured the deflection of the track and Berry strain gages for measuring the stresses in the rails. Tests were made by senior students in the Department of Railway Engineering under the direction of Professor Williams, and measurements were made both on a main-line tangent where trains passed at full speed, on a 30-deg. curve, and on a tangent yard track near a station. Some of the important results obtained by the experiments are as follows: Stresses in the end of the rail were 25 per cent. greater than at the middle; the end of a rail at a joint is subject to intense vibration resembling that of a tuning fork, so that it was impossible to attach strain gages to the rail. Professor Williams thinks that these vibrations account to some extent for the crushing of angle bars. Freight cars cause fully as high stresses as passenger coaches, notwithstanding the greater wheel loads of the latter. Ther eason is thought to be the crude construction and condition of freight-car rolling stock. Flat spots on wheels increased the stresses 50 to 100 per cent. Vibrations in the speed of a train had no noticeable effect on the tresses. Stresses measured in the head of the rail averaged from 6000 to 10,000 lb. per sq. in. The maximum deflection of the track on stone ballast was about 0.3 in.

Cleaning Glazed Terra Cotta Ornaments

A painter in Pennsylvania desirous of ascertaining how to clean white glazed terra cotta ornaments on the exterior of a building which had been badly stained by smoke wrote to the Painters' Magazine for the desired information and the following suggestions were offered in reply:

"To remove the smoke make a stout lather of soap and water and add some ammonia, and apply this to the ornaments with a soft brush. Let it remain for a little while, but before it becomes dry brush it over the whole surface with a good scrubbing brush, taking care to get into the figures at every angle, then sponge off with clean water. If the smoke stains are obstinate, the addition of finely powdered pumice to the lather and good brushing will remove them. Other stains may be removed by the use of coal-tar benzol or pure spirits of turpentine on a rough cloth.

"When using pumice it is necessary to have the finest grade, known as flour of pumice, to keep the glazed surface from being scratched or dull the lustre of the glaze."

The expansive force of steam is nearly inversely as the volume, thus, if steam at 15-pound pressure occupies 1c. ft., the same quantity at 30-pound pressure would only occupy about ½c. ft. It contains about 5½ times as much heat as 1 pound good coal, evaporated 9 pounds water which has been raised to 212 degrees. Consumption of coal per indicated horsepower per hour in first class triple expansion surface condensing engines, about 1½ pounds in double expansion, from 1¾ to 2 pounds in single cylinder condensing 2½ to 3 pounds, in locomotives 2½ pounds, and in high-pressure non-condensing simple engines three to four pounds.

LETTERS

Editor, Contract Record:

I was interested in the article on "Refuse Incinerator Guarantees Too Strict for Practical Fulfilment" published in the July issue of The Contract Record and Engineering Review. In this article the writer in the Engineering Record is quoted as saying, "The decision of city officials in Atlanta, Ga., and San Francisco, Cal., to reject high-temperature incinerators, because of the failure of the plants to fulfil certain guarantees under test, has brought the character of the specifications into question."

The specifications for the cities of Westmount, Que., Brighton, N. Y., Milwaukee, Wis., San Francisco, Cal., Atlanta, Ga., and Toronto, Ont., appear to have been drawn up by engineers or officials who fully understood what should be accomplished in a city incinerator. These engineers, knowing the different makes that have been installed throughout Canada and the United States, must have known that these conditions should be fulfilled in a high-class incinerator.

I am at a loss to understand how any engineer could get the idea that any city asking for tenders according to these specifications could be asking too much, and I should like to know how any city could make a mistake in asking for proposals according to the specifications.

Now the first essential is "that no nuisance be created during its ordinary operation of the plant," the second, "that no odors or obnoxious gases, dust or smoke be allowed to escape from the building or chimney," and the third, "that the residuum from the furnaces be thoroughly burned, hard and free from organic matter." What would be the advantage of a city spending thousands of dollars if the furnace is going to create a nuisance in its ordinary operation, and emit noxious odors and gases, dust and smoke, from the building and chimney, and only partly burn the material Would it not be less expensive to enclose an open dump and erect a chimney and connect them together? Is there any engineer or other official who can put up an argument that these conditions should be allowed?

Now the other respects in which the Atlanta, Ga., plant is criticized are in regard to "rate of evaporation," "rate of combustion," and "cost of labor per ton." Is it reasonable to suppose that, with a view to being the lowest bidder, a contractor would make the statements "high in evaporation and combustion" and "low in labor cost per ton?" As this firm claims to have placed quite a number of first-class incinerators in various cities, how can the specifications of just two be selected as being unworkable? One is disposed to ask whether the other plants were properly tested.

It is gratifying to know that there are some engineers and city officials with enough backbone to make the contractors live up to the specifications before receiving the city's money.

This firm, according to the catalogue, would appear to have had great success in Europe. But America is not Europe, and the garbage here is entirely different. In Europe the moisture contained in the garbage is only ten per cent., while on this continent it runs as high as ninety per cent., so that what might be a first-class furnace there would not meet the requirements here. In Atlanta, Ga., the city had an incinerator operating successfully in the same location as the new one for eight years, at a cost of twenty-five cents a ton for labor and fuel. This showed the officials what could be accomplished, so why should they accept a furnace that could not fulfil the specifications?

The method of burning the garbage in this make of furnace is not in accordance with the modern practice of firing. The moist material should not be fed on to a dead grate, and have the heat of the arch above reflected, with the force draft forcing air through the material the opposite way; the material should be held in suspension over the final burning grate until the moisture is thoroughly evaporated, and then fed on to the grate in a half-burned state. The fire should always be a bright burning fire, where the material from the suspended grate should be used as fuel. In this way there are no gases to be destroyed.

The material should be held in suspension so that eighty-five per cent. of the under surface is directly exposed to the elements of the fire from the final burning grate, and there should always be passage around the material so as to ensure an outlet for the products of combustion.

Provision should be made for a means of removing the ashes and clinker from the final burning grate to the ash pit without drawing them out of the furnace. If the doors are kept closed no dust or smoke will be emitted.

The writer of the article under discussion says that it is impossible to build a furnace to comply with these specifications. As a builder of incinerators, I contend that this is an injustice to the manufacturers in this trade. More, it tends to mislead city engineers and city officials generally into thinking that it is impossible to get a furnace that is not a nuisance in every sense of the word.

In conclusion, I can only say that an incinerator should be built to receive the material directly from the wagons, and designed to hold it in suspension until the moisture is thoroughly evaporated, when the material should be fed on to the final burning grate in a half-burned state, and then thoroughly consumed and afterwards fed into the ash pit without being drawn out of the furnace, all the gases being subjected to a high heat and washed before entering the chimney. If an incinerator meets these requirements our city officials will have a plant that fulfils all their requirements to the letter.

Yours truly,
F. L. DECARIE.

Pro Patria

IN the honour roll of men formerly identified with the constructional industries, and now serving with the colours, we recall the following officers: Lieut.-Col. William Hendrie, Hamilton Bridge Works Company, Limited, Hamilton, Ont.; Lieut.-Col. R. W. Patterson, Winnipeg Paint and Glass Company, Limited, Winnipeg; Lieut.-Col. J. A. Currie, M.P., Imperial Steel and Wire Company, Limited, Collingwood, Ont.; Lieut.-Col. J. F. L. Embury, Canadian Lock Joint Pipe Company, Regina, Sask.; Major Pelly, Steel and Radiation, Limited, Toronto; Major J. R. L. Parsons, Canadian Lock Joint Pipe Company, Regina, Sask.; Major T. C. Irving, Moffat-Irving Company, Toronto; Major P. R. Hanson, Dunlop Tyre and Rubber Goods Company, Limited, Montreal; Capt. E. E. Williams, Dunlop Tyre and Rubber Goods Companny, Limited, London, Ont.; Capt. Trumbull Warren, Gutta Percha and Rubber Company, Limited, Toronto (killed in action); Capt. J. T. Duguid, Imperial Steel and Wire Company, Limited, Collingwood, Ont.; Capt. C. R. Crowe, Crowe's Iron Works, Guelph, Ont.; Capt. F. R. Newman, Canadian Fairbanks-Morse Company, Limited, Toronto; Capt. Alexander Campbell, Campbell Steel and Iron Works, Limited, Ottawa (died of illness); Lieut. K. E. Drinkwater, A. B. See Electric Elevator Company of Canada, Limited, Montreal; Lieut. T. E. Ryder, Canadian Fairbanks-Morse Company, Limited, St. John, N. B.; Lieut. G. H. Saltmarsh, Metallic Roofing Company, Winnipeg; Lieut.

William Martin, Jr., Manitoba Gypsum Company, Winnipeg; Lieut. Lacey, Steel and Radiation, Limited, Toronto; Lieut. Garret, Steel and Radiation, Limited, Toronto; Lieut. Ian Hendrie, Hamilton Bridge Works, Limited, Hamilton, Ont.; and Lieut. H. C. Hatch, Canada Steel Goods Company, Limited, Hamilton, Ont.

A Well Known Consulting Engineer

As already announced in our columns, Mr. R. O. Wynne-Roberts has discontinued practising as a consulting engineer at Regina. He has now opened an office at 310 Temple Building, Bay Street, Toronto. As he has contributed frequently to our columns, his name, at any rate, will be familiar to our readers.

Mr. Wynne-Roberts' experience in municipal engineering and administration extends back over thirty-two years, when at the age of eighteen he was appointed Assistant Town Engineer of a well-known holiday resort in North Wales, and made responsible for practically all the engineering work carried on by the municipal authority. These included water-works, gas-works, sewers and roads, both new construction and ordinary maintenance, employing about 150 men. This appointment he held for seven years.

Mr. R. O. Wynne-Roberts.

During these thirty-two years Mr. Wynne-Roberts has been associated with almost every kind of municipal undertaking in Great Britain, South Africa, and Canada.

Apart from important work he had in hand as City and Water Engineer of Cape Town during the years 1898 to 1907, such as water-works, street improvement, etc., employing about 2,500 men, Mr. Wynne-Roberts had to undertake the first part of the work of stamping out bubonic plague, which had broken out during the Boer War. He was a Captain of the Town Guard, and also carried out the bulk of the work of street decorating and preparing for the reception of Their Majesties King George and Queen Mary—then the Duke and Duchess of York.

Returning to London (Eng.), in 1907, he opened an office in Victoria Street, Westminster, and among the works undertaken by him were two arbitrations. In the first case there were four different authorities, one of whom had planned to construct a street railway some miles in length on a street which ran through three separate districts. Disputes arose among the four authorities as to the details of construction, and finally the British Board of Trade appointed Mr. Wynne-Roberts sole arbitrator to settle the points of disagreement. It is interesting to note that one of the Counsels appearing before Mr. Wynne-Roberts was Lord Robert Cecil, now a member of the British Government. There were five prominent Counsels engaged to represent the various authorities, and about forty witnesses were examined. The arbitration lasted over nine days, and the evidence was recorded and printed verbatim.

Mr. Wynne-Roberts' experience in Canada has been an interesting one. In 1911 he was engaged by Mr. A. J. McPherson, then City Commissioner of Regina, now Chairman of the Saskatchewan Local Government Board, to investigate and report on the question of augmenting the supply of water. Mr. L. A. Hornton succeeded Mr. McPherson as City Works Commissioner, and it was with him that Mr. Wynne-Roberts was associated as Consulting Engineer in connection with the many schemes that were under consideration from time to time by the city authorities.

Mainly Constructional

The assets of Messrs. Cote et Frere, contractors, Quebec City, are to be sold on August 19th.

W. H. Dance & Company is the name of a new plumbing and steam-fitting firm registered at Montreal.

The George Frid Brick Company, Limited, is a new Hamilton, Ont., firm which has obtained a charter.

Among the public improvements which are now being considered by the City Council of Victoria, B. C., is the erection of an abattoir at a cost of $20,000.

Mr. George D. Mackie, City Engineer, Commissioner of the City of Moose Jaw, has been elected an associate member of the Canadian Society of Civil Engineers.

Mr. C. H. Mathewson, Resident Engineer on the Toronto Harbor Improvement project for the Canadian Government, has been appointed District Engineer for the Department of Public Works at Winnipeg.

A sign of the times is the fitting out of a shell factory at Goderich, Ont., by the Doty Engine Company, Limited. At the time of writing we are informed that the machinery for the equipment of this plant is to be purchased at once.

The Dominion Bridge Company, Lachine, are the contractors for the superstructure of a bridge which is being erected over the Petitcodiac River at Moncton, N. B. The work is being done under the supervision of Mr. A. R. Wetmore, Provincial Engineer of Public Works.

Exterior work is progressing rapidly in the erection of the First Church of Christ Scientist at Winnipeg, for which the Fort Garry Construction Company are the general contractors. The architects of this building are Messrs. Gordon & Over, of Winnipeg. The steel work is being done by the Vulcan Iron Works, Limited.

Rapid progress is being made on the Twenty-Fifth Street bridge at Saskatoon, Sask., under the direction of Mr. Fred. Saynor, the Government Resident Engineer. The upper superstructure of two of the arches is now completed, the floor slab is on, and all that has to be done is to lay the 8-inch sub-base and a two-inch asphalt wearing surface.

The Brown Construction Company, who have the general contract for the erection of the drill hall at North Winnipeg—a job costing over $100,000—have made good progress, and the interior work is now well under way. The building is two storeys high, with basement, and is of reinforced concrete, steel and brick construction. Mr. H. E. Matthews is the resident architect.

The erection of station buildings on the line of the Canadian Northern Railway between Port Mann, on the Fraser, and Hope Mountains, is being pushed with great vigor. Already the buildings at Langley, Matsqui, Glen Valley, Sumas, St. Elmo and Rosedale are completed, and at Boston Bar the material for a five-stall round-house, a 40,000 gallon tank, a turn-table and freight sidings is being assembled. The Division yards will be located at the latter point.

At a meeting of the Toronto Board of Control the other day, discussion centred around the advisability of making public a report on the Morley Avenue sewage disposal plant prepared by Mr. R. C. Harris, the Works Commissioner, and Dr. Hastings, M. H. O. In the course of the discussion the Mayor, Mr. Church, stated that the system would have to be rebuilt at a cost of between four and five million dollars. He did not see why this fact should be witheld from the public. Meanwhile the report remains in the hands of the Board.

In an endeavor to smooth away the difficulties which have arisen occasionally in connection with the period of the time during which contractors should be responsible for the maintenance of pavements and concrete sidewalks, the City Commissioners of Regina, Sask., are asking the Council to set a definite period from which responsibility shall commence. It is suggested that as the city is frequently unable to finish contracts the same year as they are commenced, the time from which maintenance shall commence shall be from the time the City Engineer issues the final certificate accepting the work on each contract. A recommendation to this effect is being brought before the next meeting of the City Council.

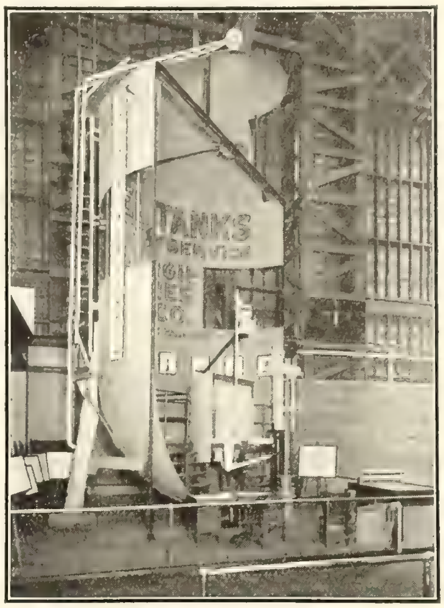
The annual report of Steel and Radiation Ltd., just issued, is of particular interest from the standpoint of the position the company is in to take advantage of war orders, rather than the showing it was able to make under the exceptional conditions that prevailed during the past year. It is announced that the contracts which the company has obtained from the Shell Committee at Ottawa are sufficient to keep the entire plants operating to full capacity, so that to a great measure this will offset the falling off in general construction work which calls for so much of the company's products. Even under the adverse conditions that prevailed, however, the company was able to meet its entire bond interest and to show profits of $13,797 over and above the amount required.

Pending the furnishing of more information, the Vancouver city council has refused a charter to the Vancouver Terminal Railway Company, which proposes to build a line into the city in connection with a big dock development scheme at the mouth of the Fraser River. Mr. J. B. Noble, Solicitor for the company, and one of the Directors, said that only with the assurance that the railway would be constructed could the money be raised to finance the entire $20,000,000 scheme, on which $1,250,000 had already been expended in securing land options. The railway which is to enter the city through a five-mile tunnel, will cost $7,000,000 or $1,000,000 a mile. Mr. Noble promised that construction would start six months after the issuing of the charter and would be completed within three years.

An installation of Gent electric clocks, which are manufactured by the well-known firm of Gent & Company, Leicester, England, is to be made at once in the Gutta Percha Building, 47 Yonge Street, Toronto, by Wm. Ashall, 442 Sherbourne Street, Toronto, who is that company's sole representative in Ontario. These Gent clocks are to replace another system of electric clocks and will include the tower clocks as well as those in the offices. Mr. Ashall has installed Gent electric clocks in the Dominion Bank's buildings at the corner of King and Yonge Streets, Toronto, and Windsor; in the Mutual Life Insurance Company's building at Berlin, and in the Allan Steamship Company's offices on King Street, Toronto. This system was installed some time ago in the Dominion Bank's building at Windsor. All have given perfect satisfaction.

An Unusual Exhibit

Among the many original exhibits at the Panama-Pacific Exposition, that of the Pittsburgh-Des Moines Steel Company commands attention. As shown herewith, it consists of a vertical half section of one of their 50,000 gallon elevated steel tanks, mounted on short posts, and so arranged that all the fittings, such as expansion joint, riser pipe, mercury gauge,



Pittsburgh-Des Moines Steel Company's novel exhibit at the Panama-Pacific Exposition.

One of the large steel tanks erected by the Pittsburgh-Des Moines Steel Co.

heater, balcony ladders, may all be visited at close range, and their details and the workmanship of the structure in general carefully inspected.

This method of exhibition has the advantage over pictures and models that all the construction details can be seen in full size, as they are actually fabricated and erected in practice. Those technically inclined can satisfy themselves as to the effectiveness of the different valves, gauges and other accessories by actually trying them out.

These tanks are designed for municipal water service, railroad service, fire protection and special purposes. They range in size from the small 10,000 gallon roof tank for sprinklers to structures of over a million gallons capacity for large water systems. The manufacturers of these tanks were awarded the gold medal, the highest award made for this type of structure.

There is also a large United States map on which are affixed pins in the shape of a miniature water tower at each location where a tank has been erected. There are almost one thousand five hundred of these structures scattered throughout the country, besides a number in foreign lands. A large collection of photographs of completed structures supplements the exhibit.

The Jittsburgh-Des Moines Steel Company has offices in Pittsburgh, Pa.; New York City; Des Moines, Ia.; Dallas, Tex., and San Francisco, Cal.

Equipment for Australian Naval Dockyard

THE largest and most comprehensive sets of tender forms, specifications and drawings yet received by the Department of Trade and Commerce are those forwarded by Mr. D. H. Ross, Trade Commissioner at Melbourne, for electrical and other machinery and equipment required for the Commonwealth Naval Dockyard at Cockatoo Island, Sydney, N.S.W. The tender forms may be inspected at the Department of Trade and Commerce, Ottawa. Particulars of the requirements, together with the date the tenders close at Melbourne, are briefly outlined, thus:—

Section A.—Tenders closing October 25, 1915. Three 1,000 K.W.D.C. geared turbine generator sets as per plan, viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyor, crane, 1,000 K.W.D.C. geared turbo set, 225 K.W.D.C. generator, rotary balancers, main switchboard and cables, condensers.

Section B.—Tenders closing October 25, 1915. Three 500 K.W. triple expansion reciprocating sets. Two 750 K.V.A. mixed pressure exhaust turbine alternators, viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyors, crane, 500 k.w. reciprocating sets, 750 k.v.a. mixed pressure turbines, 225 k.w. generator, rotary balancers, switchboard and cables, condensers.

Section C.—Tenders closing October 25, 1915. Three 500 K.W. triple expansion reciprocating sets. Two 750 K.W.D.C. mixed pressure exhaust turbine generators, viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyors, crane, 500 K.W.D.C. reciprocating sets, 750 k.w. mixed pressure geared turbines, 225 k.w. generator, rotary balancers, switchboard and cables, condensers.

Section D.—Tenders closing October 25, 1915. Five 600 K.W.D.C. Diesel engine sets, viz., 600 K.W.D.C. Diesel sets, 225 K.W.D.C. Diesel sets, rotary balancers, switchboard and cables.

List of Machine Tools for Engineering Department of Dockyard

Tenders closing October 27, 1915

Machine Shop.—Turbine boring machine, vertical and horizontal planing machine, horizontal boring tapping, studding, drilling and milling machine, horizontal drilling, tapping and studding machine, high speed turbine rotor lathe, shafting lathe, heavy double-ended, heavy duty lathes (2), high class lathe, high speed, high class lathe, high speed, vertical boring mill, vertical turning and boring mill, vertical boring and turning mill, face plate lathe, cylindrical grinding machine, broaching machine, horizontal planing machines (2), horizontal planing machine, horizontal planing machine, slotting machine, vertical shaping machine, shaping machines (2), gear generating machine, bevel gear cutting machine, thread milling machine, band saw, vertical grinder, double headed disc grinder, cylindrical grinder, boring and facing machine, vacuum cleaning plant.

Bross Finishers' Shop.—brass finishers' turret lathe, brass finishers' surfacing and boring lathe, brass finishers' surfacing and boring lathe, duplex cock turning lathe, screw cutting lathe, screw cutting lathe, grinding machine, high speed shaper, boring and facing machine, boring and facing machine, horizontal drilling machine, condenser ferrule making machine, double-headed disc grinders, ribbon grinder, automatic screwing machine.

Tool Shop.—sliding, surfacing and screw cutting lathes, sliding, surfacing and screw cutting lathes, high class horizontal planing machine, universal milling machine, die sinker, high class shaping machine, radial drill, thread milling machine, grinding machine, hydraulic press, hydraulic vertical plate bending machine, hydraulic rivetting machine, hydraulic joggling machine, high speed friction saw, hydraulic portable rivetting machine, manhole cutting machine, large hydraulic press, set rolls, multiple spindle drilling machine.

Bolt Shop.—automatic screwing machine, automatic screwing machine, drop hammer, nut facing machine, multiple head tapping machine, hot press nut machine.

Turbine Shop.—(Blading Room).—packing piece cutting-off machine, blade tipping machine, horizontal multiple-blade drilling machine.

Coppersmith Shop.—pipe screwing machine, pipe screwing machine, pipe screwing machine, pipe bending machine, punching and shearing machine, circular saw, hack saw.

Pattern Shop.—Disc grinder.

Electrical Shop.—3½-inch lathe, 6-inch lathe, pipe-cutting machine, shaping machine, pipe screwing machine, combined wet and dry grinding machine, pouching and shearing machine, radial drilling machine, universal milling machine, coil winding machine, armature coil taping machine, vacuum drying and impregnating plant.

Platers' Shop.—Hydraulic joggling machine, hydraulic manhole punching machine, notching machines (2), double punching machines with side shears, bulb angle and double bar shear and beam bending machine, plate slitting shears, band saw, plate straightening rolls, horizontal drills (2), punching and shearing machine, punching and shearing machine, double tool grinders (4), pneumatic hammer, bevelling machine, hydraulic frame benders (2), punching and shearing machines (3), radial countersink drilling machines (3), bulb angle and double bar shears and beam bending machine, plate slitting shears, horizontal drills (2), band saw, plate bending rolls (1), manhole punch, plate joggling machine, plate flanging machine.

Fitting Shop.—Planing machine, planing machine, slotting machine, double-headed shaping machine, universal miller, high speed sensitive pin drills (2), high speed boring and surfacing machine, high speed boring and surfacing machine, high speed radial drilling machine, high speed radial drilling machine, variable speed combination turret lathe, variable speed hexagon turret lathe, variable speed gap lathe, hollow spindle friction capstan lathe, variable speed hollow spindle flat turret lathe, double grinder, side disc grinder, band saw.

Plumbers' Shop.—Single head pipe screwing machine, single head pipe screwing machine, pipe flange face grinder.

Joiners' Shop.—Automatic knife grinding machine, pendulum saw, Perkins or other hand trimmer, planing machine.

Shipwrights' Shop.—Electric deck planing machine, planing machine, boring machine, steam hammers (2), steam hammer, steam olivers, forge steam hammer.

Tenders should be addressed to the Director of Navy Contracts, Navy Office, Melbourne, Australia. The departure of mails, by which tenders can be submitted within the contract time, from San Francisco and Vancouver, are as follows:—from San Francisco, September 28, due at Melbourne October 19; from Vancouver, September 29, due at Melbourne October 23. There is no duty on naval supplies.

Ottawa's "Leaning Tower"

Several years have gone by since The Contract Record called attention to the sinking of the tower on the Victoria Museum at Ottawa. A number of times we urged that experts be appointed to report on the structure, and that remedial measures be taken at once. Now an announcement comes from Ottawa that the tower is to be taken down entirely, in order to avoid a complete collapse. The Museum building was begun in 1906, and was completed two years afterwards at a cost of nearly one million dollars. Ever since the completion of the building the great square tower which adorns the central front has been breaking away, until now the structure has assumed the outward characteristics—but not the inward virtues—of the Leaning Tower of Pisa. Underpinning has been tried, but the great weight of masonry and the fact that the foundations did not go down to bedrock have made it of no avail. The Public Works Department have been struggling with the problem of bolstering it up, but on the advice of a New York expert engineer it has now been decided that the only solution is to take it down completely and rebuild a firmer foundation. The cost of rebuilding will run into the tens of thousands. Tenders have been called for the demolition.

Iron and Steel Shortages in Great Britain

A Leeds (Eng.) correspondent states that consumers of iron and steel are viewing with much concern the future prospects of securing adequate supplies to meet their requirements. The European war has materially altered the position in this and other allied trades. The munitions of war now being manufactured in Great Britain are absorbing enormous quantities of iron and steel and are thus curtailing the supplies available for commercial purposes. The position in the near future is likely to become more serious, as the Government demands for high tensile and tested steel and other equally needed materail, are rapidly increasing. One local merchant has already communicated with some of the leading manufacturers in Canada, to ascertain what can be obtained from that source, and it would be interesting to learn what Canadian firms may be able to offer in such lines as steel wire rods, copper rods or brass rods for shipment to the United Kingdom.

Fine New Bank for Vancouver

Work has been started on a three-storey bank building for the Merchants' Bank at Granville and Pender streets, Vancouver, which will cost approximately $175,000. It will occupy the 50 feet frontage where the bank's former office stood, and will extend back along Pender street for 104 feet. The main feature of the new building will be the high banking chamber, 30 feet from floor to ceiling. Above that there will be two floors of offices, and the whole structure will be equal in height to five ordinary storeys. The front and side will be composed of cut stone. The main entrance is shown on the plans as being the centre of the Granville street facade, while the entrance to the offices will be on Pender street. The banking chamber will have a novel appearance in the coloring and the counter schemes. Grey will be the color used in the marble work throughout, except the ceiling, which will be finished in Renaissance style. The cages around the tellers' desks will be of as light material as possible. Dull steel instead of brass will be used to carry out the grey color scheme. Safety deposit vaults are shown in the rear, while the main vaults of the bank will be in the basement. All up-to-date devices used in buildings of this kind will be installed, such as oil-burning furnaces and air-purifying apparatus. The plans have been drawn by Somervell & Putnam Ltd., architects, of Vancouver, and the contractors are Purdy & Henderson, Ltd., Vancouver, a well-known firm of builders. The new building will be completed in about a year from date.

Messrs. Joseph T. Ryerson & Son, Chicago, have established an up-to-date new warehouse at Jersey City, from which immediate shipments of iron, steel and machinery will be made for the Canadian trade. The firm has been well known for three-quarters of a century. Each year has witnessed great expansion, and the facilities of the Ryerson plants have been extended until now three groups of warehouses, in New York, Chicago, and St. Louis, serve the steel buyer with everything in iron, steel, and machinery, from the largest structural shape to the smallest cotton

Municipal Improvement at Bathurst, N.B.

PLANS and specifications of a water-works and sewerage scheme for the town of Bathurst, N. B., have been prepared by Mr. T. H. Higginson, engineer, 58 Beaver Hall Hill, Montreal, and the contract has been let to A. R. Clarke & Sons, St. John, N. B., at the price of $130,000. The work comprises the installation of a 350-foot concrete and earth dam, with a 30-foot spillway across Carter's Brook; a power house of fireproof construction on the bank of the brook, with two 150 horse power return tubular boilers, 1,000 gallon underwriters' steam fire pump and a 500-gallon underwriters' steam fire pump. The water from the pumps is to be conveyed across the Nipisiquit Bay through a 10 in. c.i. pipe into the town of Bathurst, a 10-in. pipe carrying the water into Bathurst Village.

In addition, it is intended to install 107 hydrants, 56 shut-off valves, 8 miles of underground piping (including 6, 8 and 10-in. pipe), together with a sewerage system of 6-in. to 20-in. pipe, with outlets provided for each house. As a secondary supply to the water system, there will be a 405,000 gallon steel gravity tank erected in the town of Bathurst, and arranged to automatically connect with the underground piping, thus giving the town reserve storage capacity. The water will be taken from Carter's Brook; an analysis by the Milton Hersey Company, Limited, shows the water to be exceptionally clear, Carter's Brook being entirely fed from springs.

The cast iron pipe to be used throughout the waterworks is Class C, with vitrified tile pipe for the sewerage system. The manholes are to be of concrete, and Robertson gullies are to be installed. Flushing connections for flushing the sewers from the water mains will be provided. A pressure of one hundred pounds will be maintained at all times.

The system has been planned to conform to the latest requirements of the fire underwriters, and a 25 per cent. reduction on all insurable values has been guaranteed as the result of the carrying out of the contract. The work is being supervised by Mr. T. H. Higginson.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Amherstburg, Ont.

The Town Council (Clerk, G. E. Pulford) contemplate paving Dalhousie and Murray Streets here. An estimate of the cost will be laid before the Council soon.

Belleville, Ont.

Tenders will be received until August 26th by the chairman of Public Works, for excavation, concrete base, binder, wearing surface and curb and gutter of a Trinidad Lake asphalt pavement, approximately 5,104 sq. yds. Plans and specifications at office of the engineer, J. Walter Evans. City Clerk, J. Wilfred Holmes. Chairman Public Works, A. C. McPhee.

Burlington, Ont.

Tenders are open and will be received by the Town Council, until August 23rd, for construction of a reinforced gallery and connections for the water-works. Plans and specifications can be obtained from the office of the engineers, Chipman & Power, 204 Mail Building, Toronto. Tenders to be addressed to J. S. Allen, secretary, Town Council, Burlington.

Chatham, Ont.

By-laws have been passed by the Town Council, providing for the construction of reinforced concrete pavements and granolithic sidewalks on various streets. Engineer, F. P. Adams.

Leamington, Ont.

A by-law has been passed authorizing the construction of a pavement 42 ft. wide, from Talbot to Nelson Streets, and 28 ft. wide from Nelson to Concession Streets. Tenders are to be called shortly. Town Councillor, Mr. Smith, Board of Works; Clerk, R. M. Selkirk; Engineer, J. J. Newton, Ouellette Avenue, Windsor.

London, Ont.

The Board of Health has recommended the construction of a new 8-in. sewer on High Street. City Clerk, S. N. Baker; Engineer, H. A. Brazier. Estimated cost, $13,000.

Maryborough Township, Ont.

Tenders are open and will be received by the Township Clerk until 2 p.m., August 21st, for the construction of a $6,000 drain. Engineer, C. D. Bowman, West Montrose; Clerk, W. W. Scott, Moorefield. Plans and specifications at I. R. Clarkes' Drug Store, Moorefield.

New Westminster, B.C.

The City Council contemplate extending the six-inch water-main on Eighth Street from Edinburgh to London Street, and that on Sixth Street from there to First Avenue. Clerk, W. A. Duncan; Engineer, J. W. Blackman.

Niagara Falls, Ont.

Tenders are called and will be received by City Clerk, W. J. Seymour, for the construction of sewers, length 1,800 ft., vitrified tile, size 10 in. Mayor, C. N. Clendening; Engineer, F. J. Anderson, City Hall. Closing date for receipt of tenders August 23rd.

Norwich South Township, Ont.

Tenders will be received until August 21st by the Township Clerk, A. McFarlane, Otterville, Ont., for the construction of 5,000 feet of tile drain and about 1,500 feet of open drain. Specifications at office of the Clerk.

Ottawa, Ont.

Work is to start at once on the construction of a sewer by day labor, at a cost of $6,000. Mayor, N. D. Porter; Engineer, F. C. Askwith.

Sandwich, Ont.

A by-law to spend $12,000 for the opening of Wyandotte Park and cross streets was defeated.

A by-law to appropriate $3,000 for sidewalks was defeated. Town Clerk, E. R. North; Engineer, Owen McKay.

Toronto, Ont.

Commissioner of Works, R. C. Harris, has recommended that a granite block pavement be laid on Yonge Street between Summerhill and Farnham Avenues. Estimated cost, $14,000.

Tenders will be received by the Commissioner of Works, R. C. Harris, City Hall, until August 31st, for the construction of a storm sewer on Dundas Street, Erie Terrace and St. Clair Avenue.

The Commissioner of Works R. C. Harris, City Hall, has recommended to the Board of Control, the construction of new sidewalks on a number of streets, at an estimated value of $5,000, and the laying of asphalt on Beachview Crescent at $7,062, and on Dupont Street at $38,959. He has also recommended the laying of Rocmac macadam on Stibbard Street at an estimate of $3,607. This is to be approved by the Committee of Works.

West Tillbury Township, Ont.

Plans have been drawn for the construction of drains here, at a cost of $3,451. Secretary, S. T. Anderson, Comber; Engineer, J. J. Newman, Quellette Avenue, Windsor.

Weyburn, Sask.

Work is in progress on the construction of the $15,000 sewage disposal plant here. The city is doing the work by day labor. Secretary-Treasurer, Mr. Inwards; Engineer, George Reed.

Wingham, Ont.

The Town Council propose to lay water mains on several streets. Town Clerk, John F. Groves.

Winnipeg, Man.

The Winnipeg Electric Railway Company have been ordered by the Public Utilities Commission to undertake a considerable quantity of underground work in order to prevent electrolysis of watermains, etc. Approximate cost, $300,000.

CONTRACTS AWARDED

Assiniboia, Man.

In connection with the laying of watermains here, contracts have been awarded by the Municipal Council to Gibault Company, Limited, St. Boniface; S. Wiggins, Kirkfield Park P. O., Assiniboia; H. Galbraith, 666 Pine Street, Winnipeg; Dominion Construction Company, 290 Selkirk Avenue, Winnipeg.

Port Colborne, Ont.

Work is to start at once on the construction of from 1¼ to 1½ miles of macadam roadway in the villages of Humberstone and Port Colborne. General contractor, Hagersville Contracting Company, Hagersville, who will furnish own supplies. Estimated cost $5,000. Town Clerk, D. Alair.

Verdun, Que.

In connection with the laying of concrete sidewalks, etc., at an estimated cost of $80,000, the contract has been awarded by the City Council (Clerk, George A. Ward, City Hall) to Warner, Quinlan Asphalt Company, 745 St. Catherine St., Montreal. City Engineer, E. H. Tanner, City Hall.

Windsor, Ont.

The contract in connection with the sewers along Giles Street and Howard Avenue, and Goyeay Street and Aley Street, has been awarded to Merlo & Ray, Tecumseh Road, at an estimated price of $7,292. City Clerk, Stephen Lusted; engineer, M. E. Brian.

Railroads, Bridges and Wharves

Alvinston, Ont.

Work is to start at once on the remodelling of the Michigan Central station here, at a cost of $3,000. The general contractor and foreman is Mr. Fraser, Michigan Central Railway, Alvinston.

Burford Township, Ont.

Tenders on the construction of two concrete and steel bridges are being received by the Township Clerk, F. W. Taylor, R. R. No. 3, Burford.

Dover Township, Ont.

Tenders are called and will be received by the Township Clerk, James Fox, Electric, Ont., until August 21st, for the construction of three concrete and steel bridges over the Big Bear Drain. Engineer, George A. McCubbin, 135 King Street, Chatham.

Etibocoke Township, Ont.

Plans are to be prepared for the erection of a bridge on Concession A opposite Lot 21. Engineer, F. Barber, 57 Adelaide Street E., Toronto. Township Clerk, S. Barrett, Islington.

Niagara Falls, Ont.
Work is now about to start on the building of a naero-car tramway system over the Niagara River at Whirlpool Rapids, by the Niagara Spanish Aero Car Company, Niagara Falls.

Toronto, Ont.
The Works Committee of the City Council have approved two sets of plans for the bridge to be erected in Mount Pleasant. Tenders will be called if plans are approved by the Railway Board. Construction, steel and concrete or concrete only.

CONTRACTS AWARDED

Moncton, N.B.
The general contract for the Bridge Superstructure over Petitcodiac River has been awarded by the Provincial Government Department of Public Works (Minister John Morrissy, Fredericton, N. B.) to Contractors and Engineers, Limited, manager E. R. Reid, Granville Ferry, N.S. Steel-work is by Dominion Bridge Company, Lachine, Que. Provincial Engineer, A. R. Wetmore.

Shawinigan Falls, Que.
In connection with the construction of the bridge over Shawinigan River, the sub-contract for steel work has been let to the Phoenix Bridge Company, 83 Colborne Street, Montreal. The general contractor is O. J. Meunier, 24 Niverville, Three Rivers. The dimensions of the bridge are to be 1 span, 100 ft. long, 19 ft. wide, concrete and steel. Secretary to the Municipal Council, O. J. Meunier.

St. Rose, Que.
Work has been started on the erection of a concrete pillar. General contractors, Plouffe, Legace and Cie, Bord a Plouffe, Que., who will purchase material. Secretary-Treasurer of the Municipal Corporation of St. Rose, Henry Chapleau. Estimated cost $4,000.

Tillsonburg, Ont.
In connection with the erection of the Simcoe Street steel bridge, the Town Council have awarded the following contracts:—steel, J. Hill and Company, Logan Road, Mitchell; cement work, A. L. Oakman and G. A. Thomas, Pearl Street, Tillsonburg. The bridge is to 62 ft. span, 18 ft. roadway with sidewalk in addition. Town Clerk, H. Coomber; Clerk, A. E. Raynes.

Public Buildings, Churches and Schools

Colchester South, Ont.
The erection of a church is contemplated, at a cost of $3,000. Material is to be selected. Owners, St. Marks A. M. E. Zion Church; address the secretary, Colchester South, Harrow, Ont.

Ford City, Ont.
Tenders on alterations and additions to the Roman Catholic Presbytery are being received by G. Jacques and Company, Architects, Boug Block, Windsor.

Halbrite, Sask.
Tenders are open for additions to the school, at a cost of $6,000, and will be received until August 21st, by the architect, J. G. Jarrett, Third Avenue, Weyburn, and the Halbrite School Board.

Joliette, Que.
Tenders on the installation of fittings at the Post Office will be received until 4 p.m., August 27th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications at offices of the Caretaker, Post Office, Joliette, Que., R. L. Deschamps, Overseer, Montreal Central Post Office, and Department, Ottawa. Specifications at office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

St. Louis Guilbert, Man.
Tenders are open and will be received by Secretary-Treasurer, F. O. Sargent, of the Wakefield School District, for the construction of a school, two storeys high, 35 x 46, concrete foundation and brick construction, to cost approximately $6,500. Architect, F. R. Evans, 170 Pacific Avenue. Closing date for tenders, August 20th.

Toronto, Ont.
Plans have been prepared in connection with the erection of a waiting room and public library accommodation at Sunnyside Bridge. Tenders will be called for if the Property Committee approve the plans. .Commissioner of Works, R. C. Harris, City Hall.

Victoria, B.C.
The matter of constructing a public abattoir, at a cost of $20,000, is under consideration by the City Council. Clerk, W. J. Dowler; Engineer, C. H. Rust.

Walkerville, Ont.
Tenders are open and will be received by the Secretary of the Dominion Government Department of Public Works, R. C. Desrochers, Ottawa, until 4 p.m. August 26th, for Post Office and Customs fittings. Plans and specifications are with C. A. Williamson, Clerk of Works, Walkerville; Thomas A. Hastings, Postal Station "F," Toronto, and the Department, Ottawa. Specification and form of tender are only to be obtained at the office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

CONTRACTS AWARDED.

Barrie, Ont.
Excavating is being proceeded with in connection with the proposed public library, to be built at a cost of $15,000. Architects, Chapman and McGiffin, 95 King Street E., Toronto. General contractor, Ball Planing Mill Company, 74 Bayfield Street; masons, Goodson and Burridge; carpenters, general contractors. Town Clerk, A. W. Smith.

Bothwell, Ont.
The general contract for the erection of the town hall has been let to Colin Reid and Brothers, Bothwell. Approximate cost, $8,500.

Cardston, Alta.
Work is to start at once on the erection of a school, at a cost of $46,250. The general contractor is H. A. Christensen, Cardston. Chairman of School Board, M. A. Coombs; secretary, J. Emer Harris. Architects are Pope and Burton, Salt Lake City. Building will consist of twelve rooms, brick and tile construction, the work to be completed by May 1st, 1916.

Cobalt, Ont.
Alterations are being made to the Public School. Chairman of School Board, W. E. T. Barton; Secretary, Alex. Hope. Architects, Angus & Angus, North Bay, Ont.; general contractor, Tully Barton.

Fort William, Ont.
The foundations are in of the Hospital Elevator under construction by the architect and general contractor, S. J. Mcqueen, 23 Murray Block, for the owners, Western Terminal Elevator, West Fort William. The specification provides for a capacity of 70,000 bushels, size 42 x 14, and of reinforced concrete construction. All work is being done under the supervision of the general contractor.

Middlechurch, Man.
Work has been started on the erection of the Old Folks Home, at an estimated cost of $11,000. General contractor, S. Brynjolfsson and Company, 506 Builders Exchange, Winnipeg. Architects, James Chisholm and Son, 807 Great West Permanent Building. Building is to be of frame and brick construction. Steel-work is being carried out by the Vulcan Iron Works, Limited, Port Douglas, Winnipeg. Other separate contracts have not yet been let.

St. John, N.B.
Work has been started on the repairs to be made to St. Stephen Church at a cost of $3,500. General contractor, E. S. Hennigar, 26 Orange Street; Pastor, Rev. Gordon Dickie.

Winnipeg, Man.
The walls are going up of the church on River Street, under construction by general contractors, Fort Garry Construction Company, Ross and Arlington, for the owners, First Church of Christ (Scientist). Architects, Gordon and Over, 47 Canada Life Building. Subcontracts have been let as follows:—masonry, carpentry and interior fittings, general contractor; steel, Vulcan Iron Works, Limited, Port Douglas, Winnipeg; roofing and plastering, not let; painting, Taylor Painting and Decorating Company, Garry Street; heating and plumbing, Beairsto Plumbing Company, Limited, 286 Fort Street; electric fittings, Levvy Electrical Company, Limited, 493 Portage Avenue.

Business Buildings and Industrial Plants

Amherstburg, Ont.
The erection of a cold storage plant, at an estimated cost of $10,000, is contemplated by the Falls Barron Company, Amherstburg. Architect has not yet been appointed.

Calgary, Alta.
The construction of ten new elevators for the Western Canada Flour Mills Company will start soon.

Collingwood, Ont.
A by-law to loan The Bryan Manufacturing Company, Minnesota Street, $20,000 to rebuild planing mills recently destroyed by fire, was defeated.

Esquimalt, B.C.
Tenders are to be called soon by the Imperial Oil Company, Limited (Manager, A. M. Abbey), for the erection of an Oil Refinery, etc., at a cost of $175,000. The construction is to consist of a two-storey warehouse, 100 x 80, concrete basement, structural steel covered with galvanized iron; wharf 200 ft. long

with 50 ft. T in deep water; boiler house 25 x 50, brick and steel construction, office 15 x 30, brick construction, stable and sheds, elevator. The Company will do tank erecting.

Galt, Ont.
Plans have been prepared in connection with the proposed alterations and additions to the factory of the Galt Machine Screw Company, Front Street. The site has been purchased and an early start is expected. Secretary-Treasurer for the company, C. K. Janzen.

Goderich, Ont.
Work is to start at once on the erection of a shell factory here for the Doty Engine Company, Limited, Brock Street. Machinery is to be purchased at once.

Hamilton, Ont.
The erection of a one-storey garage is contemplated by Willoughby Ellis, 76 Myrtle Avenue, at an estimated cost of $4,000.

London, Ont.
Additions to their factory on York Street, are contemplated by Beatty Brothers, Limited, at an estimated cost of $3,000.

The Victor Amusement Company, per G. Holding, care Street Car Company, Dundas Street, contemplate the erection of a dance hall, to cost $3,500, size, 125 ft. x 60 ft. The company expect to start work about September 15th.

Montreal, Que.
Plans are in progress in connection with the alterations to the factory of C. H. Johnson and Sons, Limited, 8 Dagenais Street, at an estimated cost of $3,000. Designer and general contractor, A. F. Byers and Company, 340 University Street.

Mount Forest, Ont.
Work has been started on the rebuilding of the store and express office owned by Mrs. Luxton, and recently destroyed by fire. Day-labor is being employed; estimated cost, $3,000.

New Westminster, B.C.
The erection of a new business block on Columbia and McNeedy Streets, at an estimated cost of $6,000, is contemplated by James Cumming, the building to be two storeys high.

Quebec, Que.
Plans are in progress for the erection of a pool room for the Quebec Olympia Company, 229 St. John Street (president, J. H. Paquet, 286 Grande Allee). Architects, Tanguay and Lebon, 20 D'Aiguillon Street. The building is to be four storeys high, 30 x 100, concrete foundation and brick construction. Estimated cost $15,000.

St. John, N.B.
The remodelling of La Provincial Bank building is under contemplation. Manager of the bank, Dufferin Harper, Germain Street. The building would be of 1 storey, 25 x 100, and would approximatelycost $12,000.

Work, by day-labor, has been started on the remodelling of a warehouse on Church and Germain Streets, for Mark Fisher and Son, Montreal, (local manager, H. H. Harvey, 93 Germain St.)

Plans are in progress for the remodelling of the store on Charlotte Street, owned by the Puddington Estate (lawyer, H. F. Puddington, Market Square). There will be a new front and fixtures installed, and the premises will be turned into a book store, at an estimated cost of $3,500.

Toronto, Ont.
Excavation is being proceeded with in connection with the erection of two stores and apartments at 1259 St. Clair Avenue, W., to cost $4,000. Owner and general contractor, M. Helfand, 1378 St. Clair Avenue W. The owner has purchased brick. Buildings will consist of two storeys, brick construction.

Vancouver, B.C.
Plans are being prepared for the erection of a factory here. The owners, W. H. Malkin Company, Limited, 57 Water Street, intend to install and purchase machinery for the manufacture of food products.

Welland, Ont.
The erection of a zinc reduction plant is contemplated by the Weedon Mining Company, Weedon Station, Que. The company have acquired a large industrial plant here and expect to be in operation by November 1st.

Zurich, Ont.
Excavating is going on for the erection of a farm building, at an estimated cost of $3,000, by Blackwell Brothers, Parr Lane, Zurich. The owners are taking charge of the general contract, the building to be of concrete and stone foundation, and frame construction.

CONTRACTS AWARDED.

London, Ont.
The walls have been started of the four stores under construction, at a cost of $10,000, by P. B. Fetterly and M. Aylesworth, Huron and Erie Streets. The architect is W. G. Murray, Dominion Savings Building. Sub-contracts have been let as follows:—masonry, John Moran, 437 Maitland Street; plastering, John Fenn, William Street.

In connection with the additions to be made at a cost of $3.000 to the factory of Beatty Brothers, Limited, York St., the brick work contract has been awarded to Evans Brothers, 905 Queen's Ave. The owners will do therest of the work.

Montreal. Que.
The following contracts have been let in connection with the factory being built on Davidson Street for B. J. Coghlin and Company, Limited, 2025 Ontario Street E.:— Masonry and brick, Gray and Wighton, 244 Pine Avenue; carpentry, D. M. Long, 204 William Street; steel, Structural Steel Company, Limited, 10 Cathcart Street; roofing, George W. Reed and Company, 37 St. Antoine Street; painting, W. E. Potter and Company, 46 Benoit Street; heating and plumbing, John A. Gordon, 301 St. Antoine St.; glazing, Henry Walker, 577 Chambord Street; metal sash, Stinson-Reeb Builders Supply Company, Read Building.

Ottawa, Ont.
The walls of the three-storey laundry under construction on Argyle Avenue are now up. The laundry is owned by the Ottawa Sanitary Laundry Company, 174 Carling Avenue, president, M. M. Pyke. General contractor, T. C. James, 140 Flora Street; architect, Richards and Abra, Booth Building. Painting, W. G. Adamson, 126 Sparks Street.

Sherbrooke, Que.
The contract for additions to the Market Building, at a cost of $7,400, has been awarded by the City Council (Clerk, E. C. Gatien) to Loomis, Dakins, Limited, St. Gabriel Street. Engineer, Thomas Tremblay.

St. John, N.B.
The general contract, in connection with the erection of a business building, has been let by the owner, James Kennedy Estate (George Kennedy), care of Vassie and Company, 20 King Street, to Stanley Williams, Prince William Street. Electric fittings are being carried out by Frank Jones, Prince William Street. Architect, F. Neil Brodie, 42 Princess Street.

Winnipeg, Man.
The contract, in connection with the alterations and additions to the Criterion Hotel, owned by John Wilkes, has been granted to the Standard Construction Company, 1004 Union Trust Building. The general contractor is also doin tghe masonry, carpentry, roofing and plastering. Steel work is being carried out by the Manitoba Bridge and Iron Works, Logan Avenue, West Winnipeg. Architect, H. W. Green, 303 McGreevy Block.

Residences

Amherstburg, Ont.
The remodelling of his residence, at a cost of $3,500, is contemplated by the owner and architect, William Hackett, care Hackett Dredging Company. The residence will be veneered with white brick and extensive colonial verandahs built.

Colchester South, Ont.
Albert Mulder, Colchester South, Harrow, Ont., will erect a new residence to replace the one destroyed by fire. Material to be purchased.

Halifax, N.S.
The foundations are in for flats to be erected by James Hilis, of Hillis & Sons, Limited, at a cost of $8,000. The architect is W. J. Busch. The Hillis firm are doing the work with their own staff.

Kingston, Ont.
The erection of two residences, at a cost of $4,000, is contemplated by William Snowden, 203½ Alfred Street. Owner will do general contracting, buildings to be of brick construction.

Montreal, Que.
Work has been started on the erection of three flats on Fourth Avenue, Rosemount Ward, by Henry Dubarras, 274 Fourth Avenue. Estimated cost, $3,500.

Plans are being prepared for three flats on Harvard Street estimated to cost $9,000. The buildings are to be three storeys high, concrete foundation, felt and gravel roofing, with hot water heating. The owners and general contractors are A. F. Byers & Company.

The foundation work has been finished for six flats on Verville Street. The owner and general contractor is John Pratt, Park Avenue.

The two residences which are being

erected by Anglins, Limited, on Marlowe Street at a cost of $10,000 have reached the roofing stage.

Ottawa, Ont.

The owners and general contractors, Charles Holbrook & Son, are buying electric fixtures and interior fittings for their apartment house on Elgin Street, which has been erected at a cost of $20,000.

Quebec, Que.

A residence estimated to cost $5,000 is to be erected on Marie de L'Incarnation Street by Wilfrid Leagre. The building will be three storeys high, of brick construction, and will be built by day labor.

Excavating is under way on a store and residence on First Avenue for A. A. Body, Ste. Famille Street. The building will be of frame and brick construction, and will cost $3,000.

Tara, Ont.

The erection of a residence on Yonge Street at a cost of $3,000 is contemplated by the owner and architect, William Munson.

Toronto, Ont.

The foundations are in of a pair of residences on Bingham Avenue, to cost $5,000. The owner is H. T. Dixon, 106 Scarboro Road, who will buy material and sublet labor. The buildings are to be two and a half storeys, brick construction, electric lighting, hardwood floors, lime and sand plastering.

Excavating is being proceeded with on a stone and residence being erected at 1182 St. Clair Avenue at a cost of $3,000. The owner is R. H. Penprays, 94 Geary Avenue, who lets all contracts. The building is to be three storeys, of brick construction.

The foundations are in of a pair of residences being built at 3491 Appleton Avenue at a cost of $6,000. The owner is W. J. Rogers, 42 Appleton Avenue, who buys materials and superintends constructions. The buildings are to be two and a half storeys, of brick construction.

The foundations are in of a $2,000 detached residence at 86 Mulock Avenue. The owner and general contractor is C. Wagner, 88 Mulock Avenue, who will superintend all work. To be of two 9storeys, brick construction, gas lighting, hot air heating, shingle roofing, birch and spruce floors, lime andsand plastering.

Work is to start shortly on a pair of residences at 30-32 Palmerston Square, costing $3,000.9 The owners and general contractors are Venn & Evans, 776 Crawford Street; they will let smaller trades. Two storeys, brick construction, hot air heating, electric lighting, lime and sand plastering, mantels.

The foundations are in of a pair of residences being erected at 235 Melita Avenue at a cost of $6,000. Owner and general contractor, J. H. Larkin, 6 Ravensden Avenue. Owner buys material and superintends construction. Two and a half storeys, brick construction, stone foundation, hot air or combination heating, hardwood floors.

Work has started on the erection of four pairs of residences on Wolverleigh Boulevard estimated to cost $16,000. The owners and general contractors are Orford & Hill, who will purchase all material. At present contracts have been let for masonry and carpentry work only. Of brick construction, electric lighting, hot air heating.

The walls have been started of a pair of residences on Atlas Avenue, to cost $6,000. Owner and general contractor, in trust, H. Lefneski, 423 Roxton Road. Owner will supervise construction. Two and a half storeps, brick construction, gas and electric lighting, hardwood floors.

Work is in progress on two two-storey brick residences on Central St. estimated to cost $4,400. The owner and general contractor is J. W. Butchart, who is buying material and superintending construction.

Westmount, Que.

The foundation work has been completed for two two-storey brick residences on Willow Avenue to cost $15,000. General contractors, Anglins, Limited.

CONTRACTS AWARDED.

Glen Falls, N.B.

Work is to start at once on the remodelling of the Manor House building, at an estimated cost of $4,000. The general contractor is James F. McDonald, 226 Duke Street, St. John, N.B. Owner, William Pugsley, Pugsley Building, St. John, N.B.

Hamilton, Ont.

The walls are up one storey of the $8,000 residence being built for William Laking on Emerald Street South. The building is to be two storeys, of brick construction. Architects, McPhie, Kelly & Darling; general contractor, masonry, carpentry and roofing, A. W. Woodhall, King Street East; plastering, J. Clapman, 349 Jackson Street West; painting, Goodale & Laidlaw, 20 Hunter St. East; heating and plumbing, Geo. Stevenson, Walnut Street; electric fittings, not let.

Niagara Falls, Ont.

Contracts for heating, plumbing and electric lighting are about to be let on the $3,500 residence which is being erected by John Dawson according to plans prepared by Architect J. U. Collins. Business Buildings........

Sub-contracts are being awarded on the $11,000 residence on Gilmour Street which is being erected for T. D. McFarlane by Taylor & Lackey according to plans by W. E. Noffke.

North Sydney, N.S.

Work has been started on the erection of a residence by L. B. Wilson, care Cable Office, who has awarded the general contract to Mr. McMilan.

Ottawa, Ont.

Excavating is in progress on the $5,000 apartments on Creighton Street which are being erected by August Boehmer for W. S. Sherwood. The construction will be brick veneer, with concrete foundation, felt and gravel roofing, electric lighting, and hot air heating.

Peterboro, Ont.

In connection with the construction of his residence at a cost of $12,000, A. W. Cressman, 212 Brock Street, has awarded the masonry contract to F. and A. E. Ham, 83 Salem Avenue, Toronto. Other contracts have not yet been closed. The building is to be of stone and brick construction, hot water heating. Architects, S. B. Coon and Son, Ryrie Building, Toronto.

Quebec, Que.

The general contract for repairs to residences on Victoria Street has been let by Dion and Freres, 84-6 Victoria Street, to A. Deslauriers, 400 St. Francois Street. Approximate cost, $3,000.

In connection with the residence being built on Third Avenue by G. J. Belanger, 1 Second Street, Limoilou, the contract for roofing has been let to A. D. Breton, 235 Kironac Street. Painting, plumbing and electrical work not yet awarded.

Seaforth, Ont.

Work is to start at once on the erection of a residence on John Street at a cost of $3,000. The general contract has been awarded by Thos. Elder to William Bristow. The building is to be of frame and white brick construction, concrete and stone foundation.

Westboro, Ont.

The walls are going up of a $3,500 residence on John Street. Owner, architect and general contractor, W. Fields. Electric fittings, J. E. Lewis; brick veneer construction, concrete foundation, shingle roofing, birch floors.

Power Plants, Electricity and Telephones

Chesley, Ont.

The Chesley Chair Company, Limited, are in the market for one direct current dynamo, with a capacity of about 100 lights.

Durham, Ont.

At a public meeting recently held, a resolution was carried to advise the village council to erect a new Hydro-electric sub-station on the site of the old market building. Village, Clerk, William B. Vollet.

Liverpool, N.S.

A By-law has been carried to make an expenditure of $10,000 on repairs to the electric plant. Town Clerk, T. R. Bartling.

London, Ont.

A proposition is up for consideration for an addition to the lighting system, to cost $10,000. The Public Utilities Commission and Board of Control now have the project in hand. City Clerk, S. Baker.

CONTRACTS AWARDED.

Oakbridges, Ont.

The foundations of the power house, under construction for Christian Bros., Duke Street, Toronto, by the general contractors, Thomson Brothers, 151 Rusholme Road, Toronto, are now in. Other contracts have been let as follows:—Heating, Canadian General Fire Extinguisher Company, Limited, 1200 Dundas Street; mechanical equipment, International Engineering Works, Limited, Traders Bank Building, Toronto.

Wawota, Sask.

Work is in progress on the installing of a telephone system by the Wawota Rural Telephone Company, at a cost of $7,300. The general contractor is W. E. Bobier, Moosomin, Sask., who will purchase all material. About 130 miles of wire and 60 pole miles will be required.

(Continued on page 51)

Tenders and For Sale Department

Tenders Wanted

Sealed tenders, marked "Tenders for Overhead Travelling Crane," addressed to the Chairman of the Toronto Electric Commissioners, will be received until noon, **Thursday, August 26th.** Specification and form of tender can be obtained at the office of the Purchasing Agent, 15 Wilton Avenue. The lowest or any tender not necessarily accepted. 33

JUDICIAL SALE OF ASSETS
of the
Bowmanville Gravel Company, Limited

Tenders will be received addressed to J. A. C. Cameron, Esq., Official Referee, Osgoode Hall, Toronto, and marked "Tender re Bowmanville Gravel Company, Limited," up to 12 o'clock noon of the **30th day of August next**, for the purchase of the assets of the above named Company. Such tenders shall be for either or both of the following separate parcels,—

(1) A certain valuable concession for the removal of sand and gravel from lots twelve and thirteen in the Broken Front Concession of the Township of Darlington in the County of Durham. These lots adjoin a creek or river running into Lake Ontario near the Town of Bowmanville, and on them there is a very large and valuable deposit of gravel to which a channel has been dredged out so as to permit of easy access for scows and other machinery necessary for removal of said gravel. This deposit of gravel is within easy reach by water transportation of the Toronto Harbor, where enormous works are contemplated by the Toronto Harbor Commission, and is also within easy reach by water transportation of the Welland Canal, where the operations now being carried on also require large quantities of gravel. The material on this concession is said to be well graded and is within a naturally protected harbor. On the site are large offices and a camp for boarding men, with equipment.

(2) A light steam tug or launch 40 ft. x 7 ft. 6 in., having 25 H. P. Engine, High and Low Pressure.

The agreement relating to the concession can be examined and further information regarding the assets of the Company can be obtained at the office of L. Waldeck Archer, the liquidator, 18 King Street West, Toronto, and the property covered by the concession and the tug or launch may be inspected upon application to him.

Terms of Sale

Twenty-five per cent. in cash and the balance at one and two months, secured to the satisfaction of the liquidator. A marked cheque payable to the liquidator of five per cent. of the amount of tender must accompany each tender, which cheque will be returned if the tender is not accepted.

The tenders will be opened by J. A. C. Cameron, Esq., at his Chambers, Osgoode Hall, Toronto, on the 31st day of August next at the hour of 11 o'clock a.m. and all who tender are then requested to be present.

The highest or any tender not necessarily accepted.

Parcel number two sold subject to a reserved bid. The other conditions of sale are the standing conditions of the Court so far as is applicable.

Dated at Toronto this 9th day of August, A. D. 1915.

J. A. C. CAMERON,
Official Referee.

This notice is published by A. Cameron Macnaughton, 18 King Street West, Toronto, Solicitor for liquidator. 33

Tenders for Street Paving

Sealed tenders, addressed to the undersigned, will be received up to 6 o'clock p.m., **Thursday, August 26th, 1915**, for the Excavation, Concrete Base, Binder, Wearing Surface, and Curb and Gutter, of a Trinidad Lake Asphalt Pavement, on a portion of Pinnacle Street, in the City of Belleville.

Plans and specifications, and all other information obtained at the office of the Engineer, City Hall.

Approximate amount of pavement 5,104 square yards. The lowest or any tender not necessarily accepted.

A. C. McFEE,
Chairman of Public Works,
Belleville, Ont.
33

Department of Railways and Canals, Canada.

TRENT CANAL

Notice to Contractors

Sluice Pipes, Valves, Etc.

Sealed tenders, addressed to the undersigned and endorsed "Tender for Sluice Pipes, Valves, operating machinery, etc., Trent Canal," will be received at this office until 12 o'clock noon on **Wednesday, September 1st, 1915**, for the manufacture, delivery of, construction and erection complete of sluice pipes, valves, operating machinery and electrical equipment for the Swift Rapids Dam, Trent Canal.

Plans, specifications and forms of tender can be obtained by application to the Chief Engineer, Department of Railways and Canals, Ottawa, or to Superintending Engineer of the Trent Canal, Peterboro, Ont.

An accepted bank cheque on a chartered bank of Canada, equal to 10 per cent. of tender, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contracts for the work at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

J. W. PUGSLEY,
Secretary.

Department of Railways and Canals,
Ottawa, 12th August, 1915.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—84240. 33

To Contractors

Separate sealed tenders accompanied by a marked cheque for 5 per cent. of the amount will be considered at the Township Hall at 4 o'clock p.m., **August 30th**, for the following work in the Township of Logan:—

1. The repairing of the N. W. drain from concession 13 to near the junction of the Grey branch.
2. From concession 10 to the outlet.
3. The repairing of the McNaught drain.

Specifications may be seen at the Clerk's office, lot 16, concession 6. The lowest or any tender not necessarily accepted.

MARVIN LEAKE, Clerk,
R. R. 5, Mitchell, Ont.
August 13, 1915. 33 34

Tenders Wanted

Tenders will be received by the undersigned, Township Clerk, up to 2 o'clock p.m. on **Saturday, the 21st day of August, 1915**, for the construction of Municipal Drain No. 3 in the Township of Maryborough, containing about 25,332.0 cubic yards of excavation.

Plans, profiles and specifications of this drain may be seen at the drug store in the village of Moorefield or at the engineer's office at West Montrose.

The lowest or any tender not necessarily accepted. Satisfactory bondsmen or a marked cheque for 5 per cent. of tender will be required.

W. W. SCOTT,
Clerk of the Twp. of Maryborough,
Moorefield P. O.

C. D. BOWMAN,, O. L. S.,
Engineer-in-charge,
West Montrose, Ont.
32 33

TENDERS
Electric Crane, Hoist, Etc.

Tenders will be received through registered post only, up to noon on **Tuesday, August 31st, 1915**, for the supply and erection of an Electric Crane, Hoist and Single Line Clam Shell Bucket at the Main Sewage Disposal Works, Toronto.

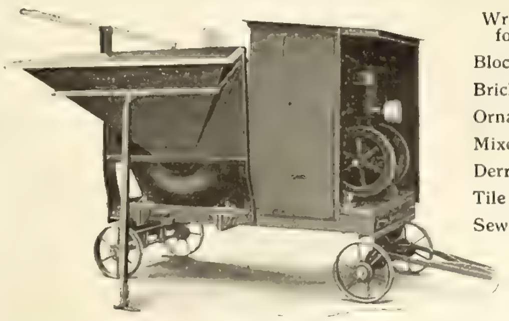
Tenders must be addressed to the Chairman, Board of Control, City Hall, Toronto, and be plainly marked on the outside of envelope as to contents.

Specifications and forms of tender may be obtained at the Works Department, City Hall.

Tenderers must comply strictly with conditions of City By-laws as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.
Toronto, August 11th, 1915. 33

For Additional Tenders See Page 52



"Windsor Ideal" Batch Mixer

Write us for information on:
Block Machinery,
Brick Machinery,
Ornamental Molds,
Mixers, Tampers,
Derricks, Screens,
Tile Machinery,
Sewer Pipe Molds,
Fence Post Molds,
Waterproofing, etc.

Ideal Concrete Machinery Co., Ltd.
WINDSOR, ONTARIO

Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

To Contractors, Railroads, Mines, etc., Using

Carbic Flare Lights

Notice.

All orders for CARBIC CAKES, for use in CARBIC FLARE LIGHTS will receive prompt attention if forwarded direct to this office.

Wire or Write **Immediate Shipment**

CONTRACTORS

Are you using a CARBIC LIGHT on that RUSH JOB? If you are not you are losing TIME and MONEY, and it will pay you to sit down and figure it out.

Good Light is most essential in order to make a good job, and good jobs add to your reputation as a Contractor.

On your reputation depends your future.

Use a CARBIC LIGHT on the job, and insure yourself against faulty construction, which in time will ruin your reputation as a Contractor.

Full particulars on Application

W. L. FOSTER
8 Lombard Street - Toronto, Can.

Osgood

"18" 3/4-yd. Traction Revolving Shovel, with horizontal type hoisting engines. Independent steam steering engine operated from either side of shovel; also hand steering device.

Full submerged tube type boiler built to pass inspection in all Canadian Provinces.

Shovels in stock for immediate shipment.

The Marion Osgood Company
P. O. Box 515 MARION, OHIO
Canadian Agents:—Kelly Powell, Limited—Head Office 602 McArthur Building, WINNIPEG. Branch—MONTREAL

INGERSOLL, ONTARIO

Tenders for Pavement

Sealed tenders, addressed to W. R. Smith, Town Clerk, will be received up to noon, **September 2, 1915**, for the construction of approximately 1,800 square yards of concrete pavement and 1,200 lineal feet of concrete curb.

Plans and specifications may be seen at the office of the Town Clerk, and at the office of the Contract Record, 347 Adelaide Street West, Toronto.

The lowest or any tender not necessarily accepted.

ERNEST J. HOLLAND,
Town Engineer.

33

TOWN OF THOROLD

PROVINCE OF ONTARIO

Sewerage System

Sealed tenders will be received by the Town Clerk until 8 p.m. **Wednesday, August 25th, 1915**, for the construction of a system of sanitary sewers in St. Andrews Ward, comprising about **14,225** lineal feet of pipe laying; also for the construction of sewage pumping station.

Sewer pipes are to be furnished by contractor.

Machinery to be furnished and installed by corporation.

Plans and specifications may be seen at the resident engineer's office, Thorold, or at the office of the chief engineers, Mail Building, Toronto, on and after August 13th, 1915.

The lowest or any tender not necessarily accepted.

JOSEPH BATTLE, Esq., Mayor.
D. J. C. Munro, Esq., Town Clerk.
CHIPMAN & POWER, Engineers.

32

FOR QUICK SALE
A One-Ton Motor Truck
In Excellent Condition
Will Sell Cheap for Cash
Apply J. LANG,
40 West Richmond Street, Toronto

Fires

Cache Bay, Ont.
The sawmill of Geo. Gordon & Company, Limited, has been destroyed by fire. The loss is $125,000, and the insurance $83,000.

North Vancouver, B.C.
Five cottages on Fell Avenue, belonging to Capt. Chas. Cates, 163 Hastings Street West, have been destroyed by fire. The loss amounts to $5,500, partly covered by insurance.

St. Thomas, Ont.
The smoke house, sausage room, and warehouse of the St. Thomas Packing Company, Limited, Gravel Road, have been totally destroyed by fire. The loss is $15,000, which is covered by insurance.

Thorold, Ont.
M. Kennedy's store and boarding house on Front Street was totally destroyed last week.

Miscellaneous

Anique, Que.
J. A. Brillant is receiving prices, catalogues and other information on concrete mixers, library fittings, seating fixtures, shutters, woodworking machinery, Douglas fir, interior trimmings, and hotel furniture.

Orillia, Ont.
Mr. T. B. Cramp, 37 Barrie Road, W., wants prices, catalogues, etc., on the following:—Cement, fireproofing, steel, metal lath, plate glass and joist lumber.

Toronto, Ont.
The Toronto Hydro-Electric Commissioners, 226 Yonge Street, will receive tenders until August 26th for the supply of one overhead travelling crane. Specifications at office of purchasing agent, 15 Wilton Avenue.

CONTRACTS AWARDED.

Winnipeg, Man.
In connection with the tunnel between the Central Power House and the Law Courts, the Provincial Department of Public Works have let the contract for concrete work to Tremblay and Company, 81 Sterling Bank Building, at $6,356, and the contract for piping to Cotter Brothers, Fort and St. Marys Streets, at $3,970.

Late News Items

Artemesia Township, Ont.
Tenders on the construction of a reinforced concrete bridge will be received until 6 p.m., August 21st, by the Township Clerk, W. J. Bellamy, Flesherton, Ont. Plans and specifications at office of the Engineer, R. McDowall, C. E., Owen Sound, and of the Clerk.

McAuley, Man.
The School Board have let the general contract for the erection of a school to George Minkley, 1935 Robinson Street, Regina, at $12,875. Fittings will be purchased by the general contractor.

Montreal, Que.
In connection with the flats being built for M. Masson, 926 St. Denis Street, the carpentry contract has been let to the general contractors, U. Pauze & Fils Company, 326 Greene Avenue, and the contract for brick and stone work to O. Archambault, 610 Parc Lafontaine.

Ontario Province
Tenders will be received until noon, September 1st, by J. W. Pugsley, Department of Railways and Canals, Ottawa, for the supply and construction of sluice pipes, valves, operating machinery and electric equipment for Swift Rapids Dam. Plans and specifications with the Superintending Engineer, Trent Canal, Peterborough, and at the Department, Ottawa.

Ottawa, Ont.
In connection with the apartments being built at Laurier and Chapel Streets by Leon Petegorsky, 87 Goulbourne Avenue, the contract for painting has been let to W. J. Carson, 293 Laurier Avenue W., and for heating to Coldrey & Chapman, 348 Rideau Street. Plastering by day labor.

The contract for heating and plumbing at the apartments in course of erection for Frank Bossie, 542 Laurier Avenue W., has been awarded to Gauthier & Company, 307 Dalhousie Street.

Owen Sound, Ont.
Work has been commenced by day labor on the erection of an addition to the tannery of the McQuay Tanning Company, Limited, 1852 Third Avenue. Approximate cost, $15,000.

Regina, Sask.
In connection with the Mail Order Building to be erected for the Robert Simpson Company, the contract for the supply of steel reinforcing bars has been awarded to the Burlington Steel Company, Limited, Hamilton, Ont.

St. John, N.B.
Progress is being made on the erection of stores for Scovil Bros., King Street, by the general contractors, B. Mooney & Sons, 112 Queen Street. The contract for galvanized iron and roofing work has been let to John E. Wilson Company, Limited, Sydney Street. Estimated cost, $60,000.

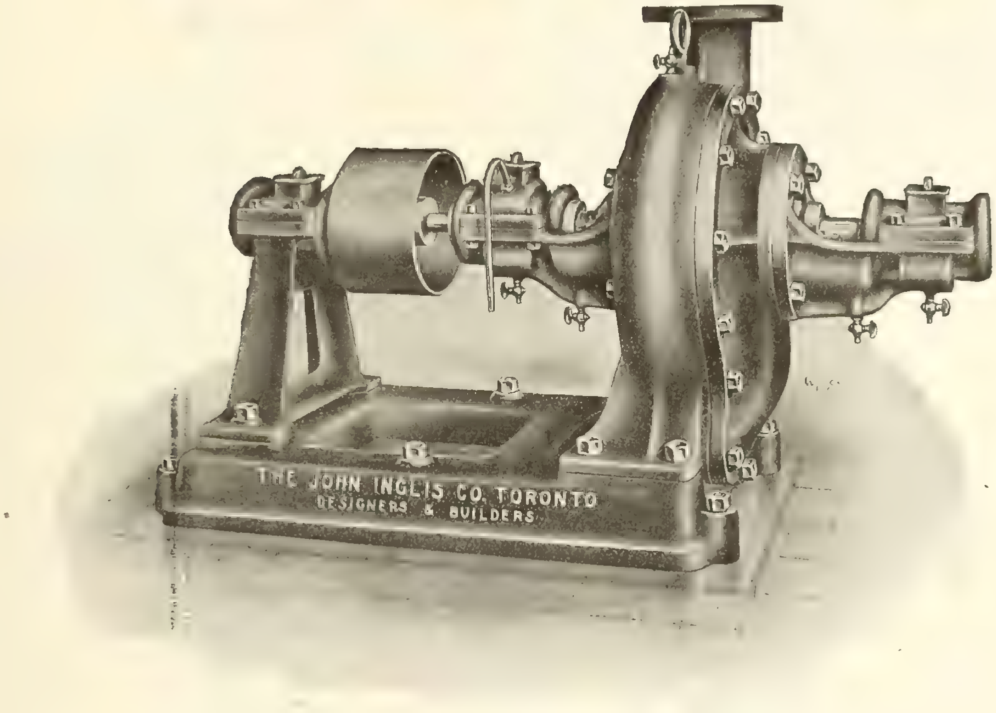
Thorold, Ont.
The work on sewerage extension in St. Andrew's Ward, for which tenders are being received, will be sub-divided into the following contracts:—(a) sewers in westerly section of the Ward; (b) sewers in easterly section of the Ward; (c) cast iron sewage force main; (d) sewage pumping station. Engineers, Chipman & Power, 204 Mail Building, Toronto.

Winnipeg, Man.
Tenders will be received until August 21st by the Chairman of the Board of Control for the supply of between 1,000 and 2,000 square yards of creosoted wood paving blocks. Specifications at office of the Engineer, W. P. Brereton, 223 James Avenue.

A writer in the American Machinist says, in laying out drawings of machinery, it often happens that the draughtsman desires to space off a part of the work into a number of small divisions, such as, for example, the threads of a screw, the teeth of a rack, or a series of equi-distant lines upon which to plot a curve. If his scale happens to be in divisions corresponding to those desired, it may be used; otherwise the method below is useful:—Take an ordinary thread gauge and draw it lightly over the point of a soft lead pencil until the teeth become slightly coated with graphite. Then press it firmly upon the drawing at the place where the divisions are desired. It will be found upon lifting the gauge that each tooth has left its imprint on the drawing. This series of little black dots may then be used as the desired spacings.

R. O.
WYNNE - ROBERTS
Consulting Engineer
310 TEMPLE BLDG., BAY STREET
TORONTO
Water Supply, Sewerage, Sewage Disposal, Civic and General Engineering, Arbitrations, Investigations, Valuations, Reports, etc.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

INGLIS' PRODUCTS ARE "MADE IN CANADA"

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Warehouse Space To Let

5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally located at Adelaide and Charlotte Streets.
Light on four sides
Passenger and freight elevator
Vaults
One block from four car lines
Floor area 6,300 sq. feet, each floor.

For further particulars ask

Hugh C. MacLean, Limited
347 Adelaide St. West, Toronto
Phone Adelaide 2700

BOOKS
For
Engineers and Contractors

The following Books are Offered subject to Previous Sale:

British & Foreign Building Stones, by John Watson, Published in 1911 at the University Press, Cambridge, England. 483 pages. Price 50 cents.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

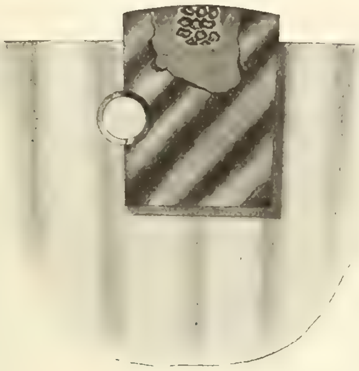
Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

Contract Record
347 Adelaide St. West, Toronto, Ont.

Save 50%
on
Stone Sawing



Anderson
"Diamond Reinforced" Saw Tooth

After costly experimenting, we have produced a Saw Tooth which enables diamond saw owners to reduce their cutting (independent of labour) by 50 per cent.

This Tooth is the "ANDERSON REINFORCED DIAMOND SAW TOOTH."

This Tooth contains, instead of one solid diamond, a number of small pieces making up the same weight. The double advantage being that it COSTS LESS and LASTS LONGER.

With the Reinforced Diamond Tooth the diamond is inserted in a broken condition, and perfectly reinforced with steel. As the tooth wears down only small pieces can go to waste, mere dust, and it is impossible for them to suffer loss through entire or partial breakage so common with teeth cutting the harder building stones.

When the first layer of the small pieces have done their work and are worn away, the second layer comes into cutting action, and so on, until the teeth are worn out.

Write us for prices.

Geo. Anderson & Co.
of Canada Limited
QUEBEC BANK BUILDING,
MONTREAL

Buy Sheet Metal By Name

GUILTY ?

Are you in the habit of using such terms as "galvanized sheets" — "iron sheets" — "steel sheets"—"sheets"—"sheet metal"—"black sheet iron" — and other meaningless phrases in your specifications?

Do you know what is actually furnished when you use those terms?

The most inferior grade of sheet metal could be furnished on such specifications.

Play safe—specify

TONCAN METAL
SHEETS

They are corrosion-resisting

The name "Toncan Metal" on your specifications assures the use of the most durable sheet metal made from iron ore. And the cost is moderate.

All genuine Toncan Metal bears the Toncan Metal Stencil.

Get the "Text Book on Corrosion" without cost.

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OSHAWA, ONT.
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Always in Stock

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Corrugated Sheeting
Send for Stock List

STANDARD STEEL CONSTRUCTION CO.
LIMITED
WELLAND - CANADA
MANUFACTURERS AND ERECTORS
Steel Buildings and Bridges

BITUNAMEL

Unsurpassed for waterproofing foundations and preventing rust and corrosion on exposed iron and metal work.

WRITE FOR SAMPLE

The Ault & Wiborg Co. of Canada Ltd., Varnish Works
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STRUCTURAL STEEL FOR QUICK DELIVERY

We carry in stock at Montreal 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

Bridges, Roof Trusses, Columns, Girders, Beams, Towers and Tanks, Penstock.

Estimates furnished promptly, Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
Main Office and Works, Montreal

Do You Want Crushed Stone?

That is Clean, Tough Stone of a Quality suitable for Macadam Road and Concrete

We can supply you in any size or quantity.
Our service is unexcelled and our prices right.
Phone or write us for quotations when you are in the market.
Office—M 4515—M 4516 Residence—P 2278

Crushed Stone Limited
47 Yonge St. Arcade, Toronto
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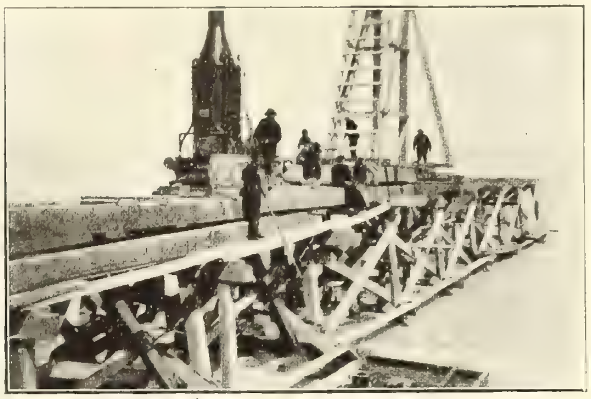

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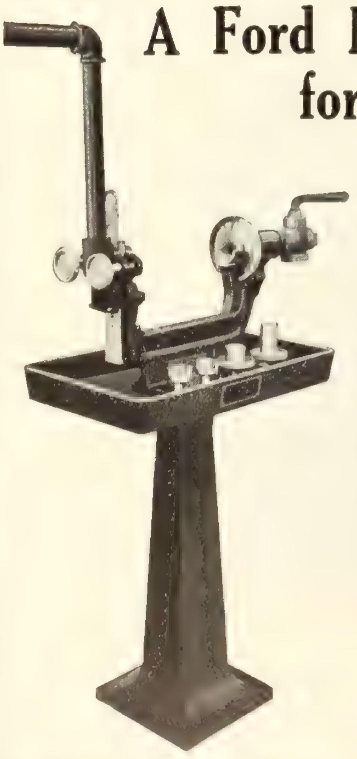

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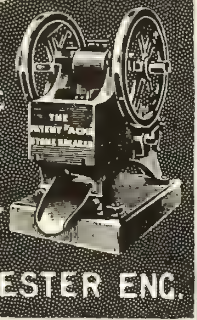
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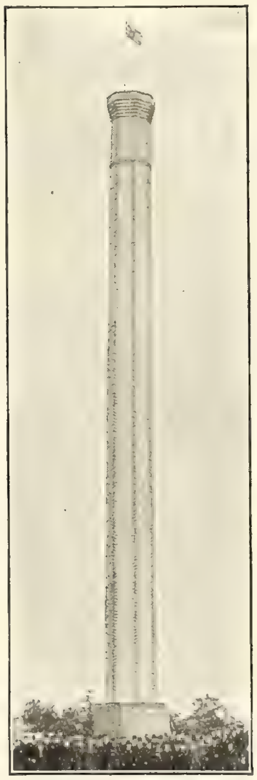

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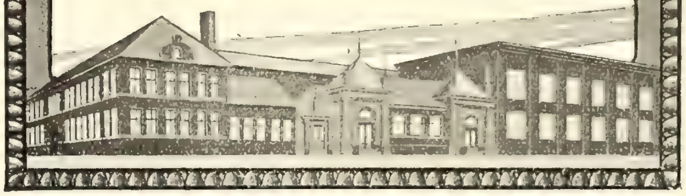

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TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12-in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4-in., 25c per ft.; 6-in., 40c ft.; 8-in., 55c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.75; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. net cash. Copper bearing sheets—Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20; $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13½c basis; African hemp, 13½c.; sisal rope, 11½c. basis; lath yarn, 10¼c. Boiled linseed oil—in barrels, 72½c. per gal. of 9 lbs. Raw linseed oil—in barrels, 70c. per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20. Bags 10 cents extra.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¾-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; bandsawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 64)

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Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

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"Pillar Brand"

Hardwall Plaster, Cement Plaster
Land Plaster, Whitewall Finish, Plaster of Paris

For the best results from gypsum products—specify "Pillar Brand." This brand of hardwall plaster is mixed with the highest grade goat and cattle hair, thoroughly washed and specially prepared. It makes a hard, clean, substantial wall.

"Pillar Brand" plasters are noted for their whiteness, quick setting qualities and hardness.

Shipments by rail or water.

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The Iona Gypsum Co., Limited

Head Office, **Sydney, N. S.** ***Mills,*** **Iona, N. S.**

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page (66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $11.50 per 100 lbs.; boiled linseed oil, in bbls., 98 cents per gal.; raw linseed oil, in bbls., 95 cents per gal.; dry red lead, $10.00 per 100 lbs.; putty in bulk, $3.25 per bbl.; putty in 25-lb. tins, $3.75; turpentine, in bbls., 80 cents per gal. Mixed paint, ordinary colors, per gal., $3.10.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 350 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick—Common red brick, $9.00 f.o.b. warehouse. $9.00 in car lots f.o.b. Vancouver; pressed red brick, $35 at warehouse; pressed buff brick $40 at warehouse; $33 in car lots; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35 in car lots, $40 in warehouse; fire clay, $12 per ton in car lots.

CRUSHED STONE, SAND, AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.25 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galavanized iron—28 gauge, $5.75 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.00 in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$13 in car lots.

Alca lime—$16 per ton.

Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal., $2.75 to $3.25.

White lead—ground in oil, $11.50 to $12.50 per 100 lbs.

Boiled linseed oil—in bbls., $1.02 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.00 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

MITCHELL CRUSHER

For Stone
and Ore

We manufacture a complete line of crushers. Also crushing equipment for quarries, mines, contractors and builders.

Mitchell crushers are sturdily built to crush the hardest materials.

Get our prices.

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Concrete
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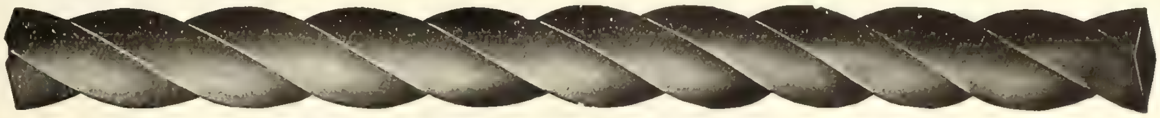
MITCHELL CRUSHER MANUFACTURING CO. LTD.

Burlington Steel Co.

(Formerly Canada Steel Co., Ltd.) Limited

Hamilton, Canada



STEEL BARS

for Reinforcing Concrete

Rounds, Squares, Flats, Twisted Squares, Angles, T-Bars,
Ovals, Half Ovals, Half Rounds, Bands, Special Sections.

3/4", 7/8" and 1" Channels for use with Metal Lathing

CROSS ARM BRACES—POLE SHIMS

Plain and Galvanized

Prompt Shipment from Stock

"Come and take a look at the 9 x 12 you furnished us, it is doing fine work."

Mighty nice to be greeted in the above manner, particularly gratifying because the Engine was handling a big clamshell continuously—which as you know is one of the hardest forms of service—and the speaker a man of broad experience.

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Hoisting and Material Handling Plant
is our specialty.

Let us have your inquiry for whatever you need in the way of HOISTS, CLAMSHELLS, PUMPS, DERRICKS, DREDGES, Etc. We can interest you.

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Toronto Branch:
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KELLY-POWELL, LTD., McArthur Bldg., Winnipeg, Man.

James Thomson, President. J. G. Allan, Vice-President. James A. Thomson, Secretary.

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Manufacturers of

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

CAST IRON PIPE

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

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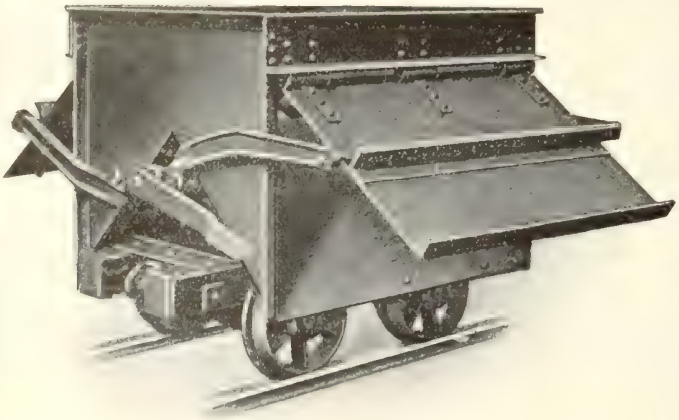
Made to dump both sides, both ends, or all round.
All sizes and designs. Steel Construction.

Mine Cars **Industrial Cars**



The side dump car, U or V shaped, or constructed as shown above, offers many advantages over other styles for brickyards, contracting work, sand pits, mines, and industrial purposes. Made with chilled semi-steel wheels, cold rolled steel axles, high carbon roller bearings in dust proof boxes.

BRICK MAKING MACHINERY of all kinds. Special attention paid to AUTOMATIC CUTTERS and the equipment of brickyards with ARTIFICIAL DRYERS.

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(Successor to Bechtels Limited)

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Drifting Sand Filters

THIS system has been accepted by the City of Toronto after a thorough test, and a plant having a daily capacity of 60 million imperial gallons is now under construction. The filters can be installed in either the gravity or pressure systems.

Designs and estimates furnished on application.

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Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

ORNAMENTAL IRON WORK
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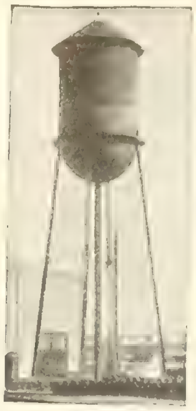
Concrete Bonding
Elevator
Overhead Guards

Enquiries solicited.

CANADA WIRE & IRON GOODS CO., Hamilton.



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Our Specialty is the Design, Manufacture and Erection of **Elevated Steel Tanks** for Municipal, Railroad and Factory Service.
We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

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of the receiver type is a difficult piece of plate work to make absolutely and permanently tight. That is the reason why we developed our Welded Separator—not a single rivet in its construction, every joint and seam being a perfect weld. The shell is lap welded, the heads are set in by our patented Line Weld method and the necks are attached by our patented Interlock method.

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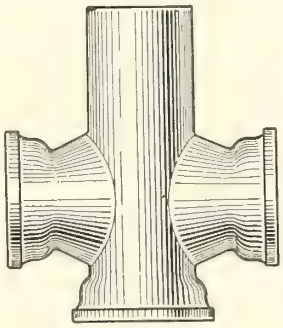
Warren
Cast
Iron
Pipe



Your requirements can be filled and your specifications carried out to the letter whether they be for standard or specials in cast iron pipe.

Large stocks always carried on hand.
Prompt shipments.

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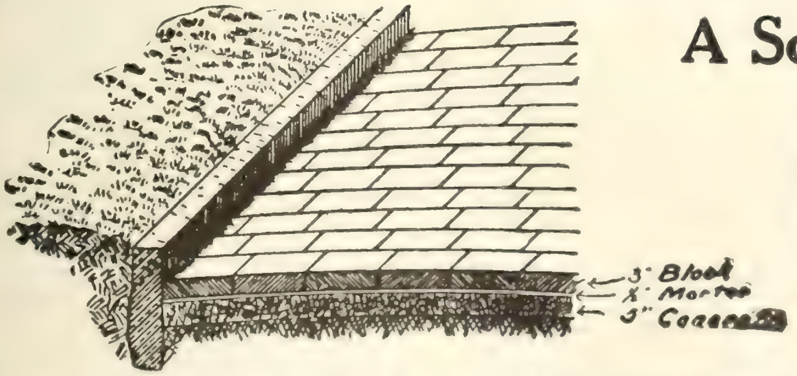

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Durable and Non-Abrasive.
Non-Absorbent and nearly Noiseless.
Unaffected by extremes of Temperature
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Easily Repaired and easily Cleaned.

These requirements are met by
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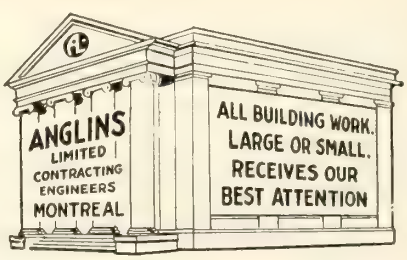
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Cement Testing and Reinforced Concrete Inspection.

Mill, Shop and Field Inspection of Steel Structures and Bridges.

Tests and Inspection of Iron and Steel Pipe, etc.

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Steel Beams, Channels, Angles, Plates, Column Sections, Etc., Always in Stock

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Locomotive Turn Tables and Structural Steel and Iron Work of all descriptions.
Estimates furnished on application.

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Three Rivers, Quebec
Wayagamack Pulp and Paper Co., Ltd.
50,000 gallons. 149 feet to top
120,000 " 100 feet to top

Hemispherical and Segmental Bottoms

Manufactured at Pittsburgh, Pa.

Erected Anywhere

We have special designs for Municipal, Railway and Industrial service.

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The Maritime Bridge Company, Limited

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Bridges—Steel Buildings
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Towers—Girders and
Structural Steel Work
of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, **New Glasgow, N. S.**

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Toronto, Canada

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Capacity: 18,000 Tons Annually

We build and erect all kinds of Structural Steel Work Roof Trusses, Bank and Office Railings, Stair Work, Elevator Grilles, Fire Escapes, etc.

Over 5,000 Tons in Stock of

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or for any temporary installation why install an expensive pump when a cheaper one will answer your requirements just as well. There are no low priced pumps on the market equal to our famous

Class "M" Centrifugal Pumps

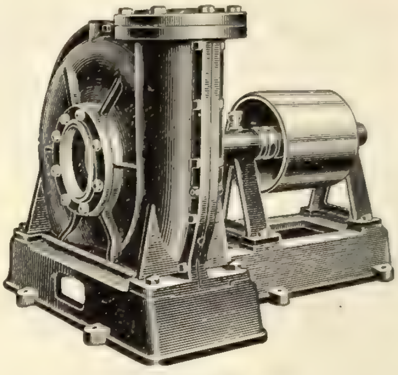

Fig. 630

"Made in Canada"

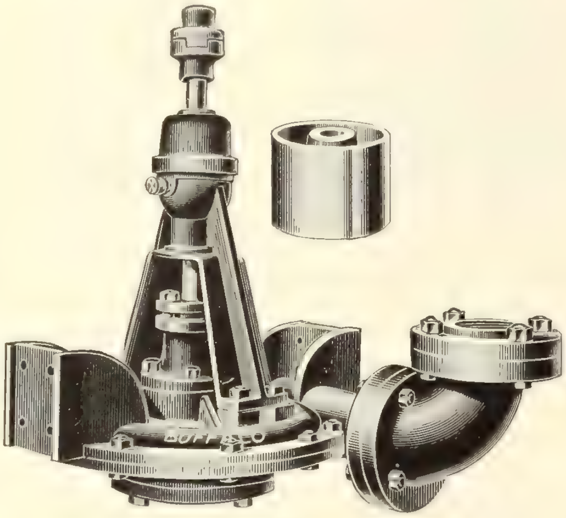

Fig 1055

Built horizontal and vertical for capacities up to 3000 gallons per minute and for heads as high as 65 feet. Correct design and careful workmanship assure long life and low repair bills. It will pay you to get our prices.

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"KINGSTON" Clams and Grab Buckets

Combine simplicity and solidity of construction with strength of material making them suitable for all classes of construction. Where difficult material is to be handled and continuous operation essential the "Kingston" will prove reliable and efficient.

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Designers and Manufacturers of
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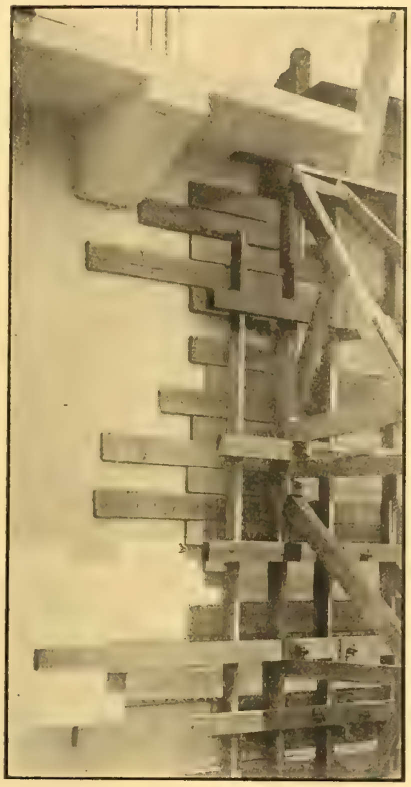

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The picture tells the story. Plate and loop the wire over. Thread up the wire on the spindle—and tighten up—the ratchet holds it taut. The wire can't slacken.

Made of two simple, strong cast iron parts, and a wrench is furnished.

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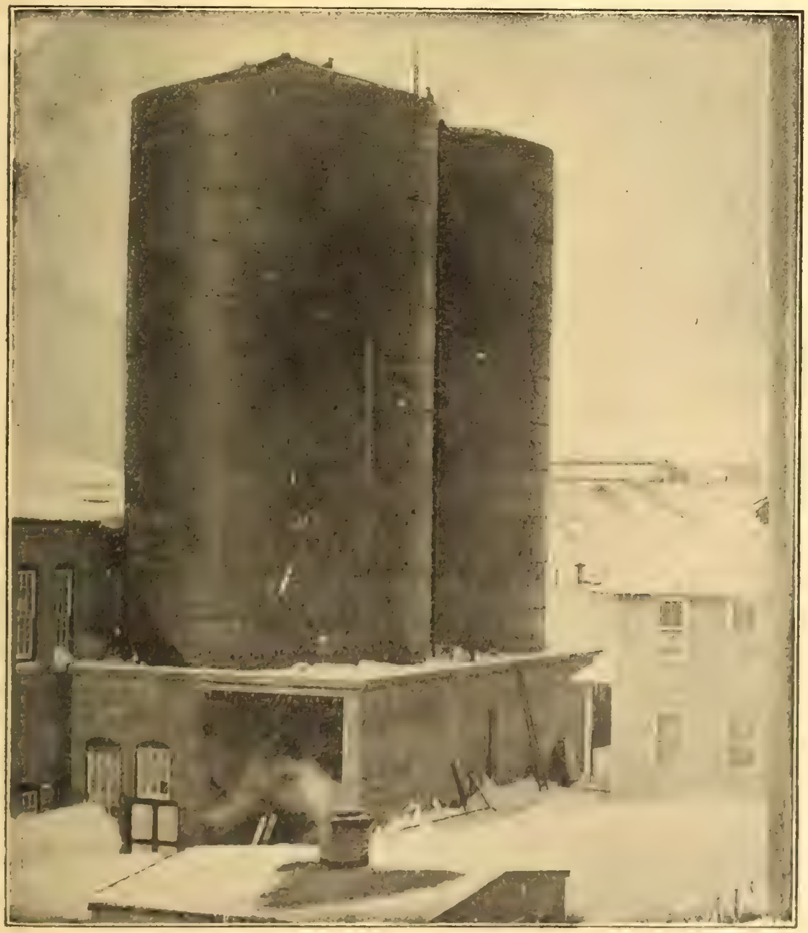

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to support them.

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Stocks carried in Montreal, Winnipeg and St. Catharines

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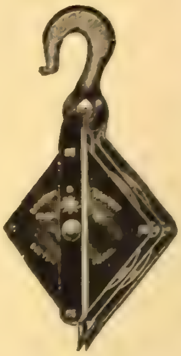

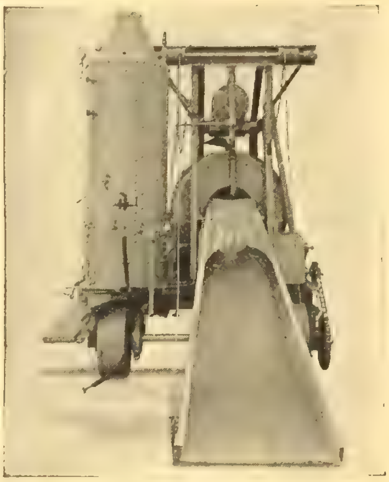

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"The Machine with all the Good Features"

WHEN deciding upon a special concrete plant you should avail yourself of all the experience you can.

We will be pleased to submit designs of a plant to take care of your special requirements if you will send full particulars relative to the work to be undertaken.

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Cement Bag Cleaner

An Inexpensive Machine for

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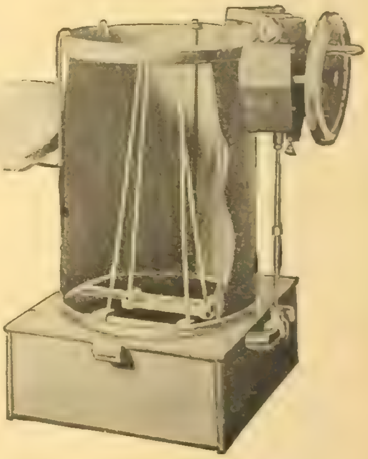
Saves Cement that is ordinarily lost.

From one to two barrels of cement are saved out of every thousand bags.

When you return bags only partially cleaned, you not only lose the cement but pay freight on it as well.

Let us quote you



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HEAD OFFICE
MONTREAL
Vancouver, B. C.

Vol. 29 Toronto, August 25, 1915 No. 34

ESTABLISHED 1886

Contract Record and Engineering Review

Heavy and Light Steel Plate Construction

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Storage Tanks
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Smoke Stacks
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Penstocks

WATER TOWERS
For Municipal and
Industrial Water Supply
And Sprinkler Systems.

Pressure Tanks
Riveted Steel Pipe
Tank Wagons
Concrete Forms
Caissons

The Toronto Iron Works, Limited
Toronto

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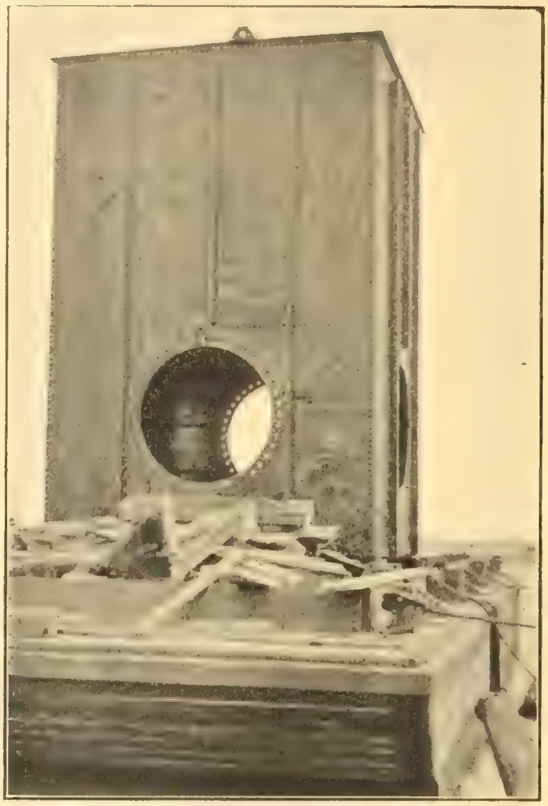

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Steel Plate

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Depend on the trade mark

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It's not merely a design or a picture to catch the eye. It is a name that means something to you. It means quality. It means satisfaction. It means service. You will find this name on all genuine Mueller goods. It's on the

MUELLER

Extension Service Boxes

The very best value in service boxes ever offered the trade. Their absolute dependability has been proved in thousands of cases.

Here is a box that meets all requirements. Made in Arch or Minneapolis pattern all sizes. We would be pleased to figure on your needs.

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Ltd.
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Makers of high grade Water, Plumbing and Gas Brass Goods.

28 "Service" Branches
Throughout Canada

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Montreal, P. Q.

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No matter how extensive your rubber goods requirements may be, we have an unrivalled experience, unequalled resources, and the financial stability to handle your order with maximum efficiency.

And furthermore, what is equally true—no order is too small to warrant our prompt and careful attention.

Our line-up is complete, our quality is unexcelled and our prices are right. Let us show you what we can do.

It is our desire to serve you.

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28 "Service" Branches
Throughout Canada

To Secure

ECONOMY* and *DURABILITY

Construct Your

SEWERS

from

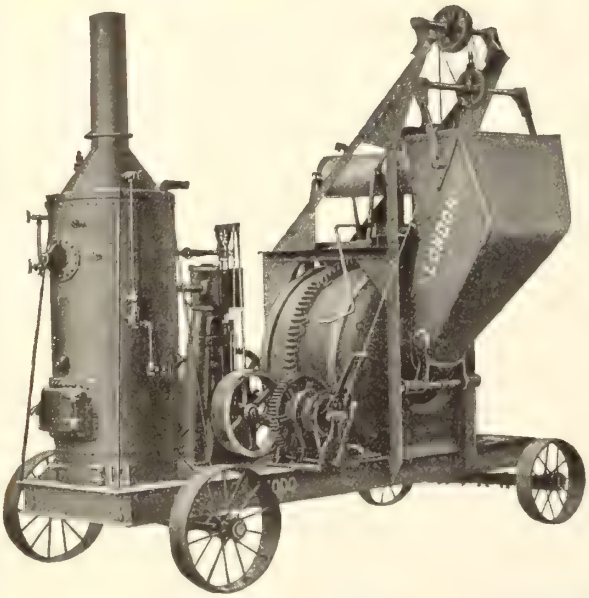
Reinforced Concrete Pipe

Manufactured by

Dominion Concrete Co.
Limited
KEMPTVILLE - ONTARIO

"Better good pipe at a fair price than poor pipe at any price."

N. B. The adjoining illustration shows a line of 42-in. pipe in a trench ready for filling.



LONDON Batch Mixer

LOOK HOW HIGH THE SKIP RAISES! Not necessary to pound the bottom out of the skip in order to charge the drum.

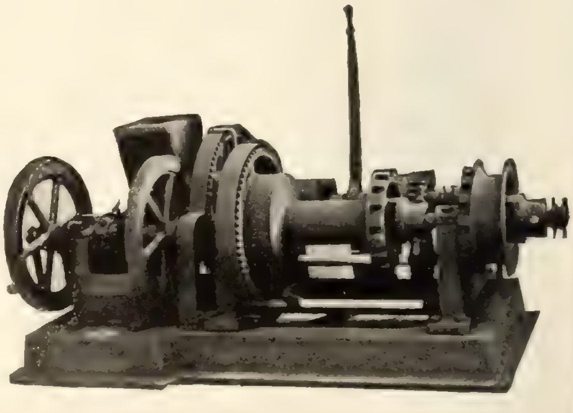
London Batch Mixers are Built to Last a Life Time. They will produce a **Batch of Concrete every Sixty Seconds. A Creamy, Smooth Mixture. Just what your Engineer is looking for.**

Why two thousand in use? Because every Mixer sold sells ten more.

We make **Twenty-three different sizes of Mixers.** Send for Catalogue No. 1.

CHAMPION HOIST →

Direct connected. No lost power. Built very strong. **A high grade hoist at a moderate price.** We make a full line of Hoists, both Gasoline and Steam.
Send for Catalogue No. 23, stating requirements.



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Branches and Agencies in every large City in Canada.
Worlds Largest Manufacturers of Concrete Machinery and Cement Working Tools.

BUCYRUS DRAGLINE

Making double track railroad fill for Government Railway, Welland Ship Canal.

Loaded 242 Cars in 10 Hours

If in the market for dredges, steam shovels, pile drivers, wrecking cranes, draglines, ballast plows, dump cars, spreaders, locomotives, road making machinery, flat cars, passenger coaches, wire rope, etc., write us for prices and catalogues.

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and Prisms May Go
But LUXFER Stays on Forever

When the Luxfer Prism was first manufactured some 17 years ago it had many imitators and a few competitors. They have all died off and "Luxfer" is still the one best prism to solve daylighting problems for factories, stores, warehouses and offices.

Specify "Luxfer" the first and best prism and you will get the daylight you are after.

LUXFER PRISM COMPANY, LIMITED
100 King Street West, Toronto, Ont.

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(Continued on page 12)

DE LAVAL
CENTRIFUGAL PUMPS

Reduce Pumping Costs

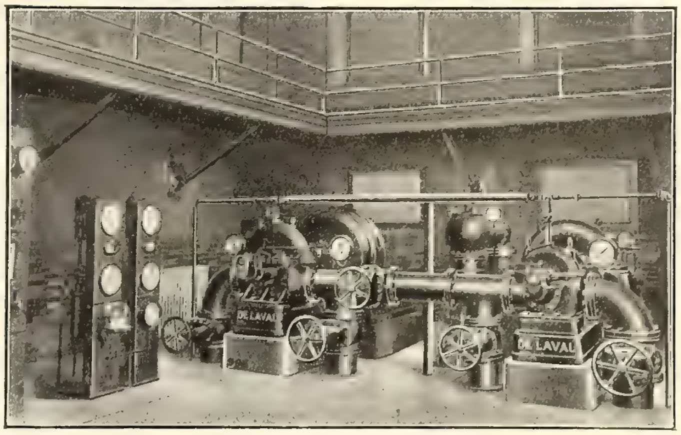
The centrifugal pump contains no gears, valves, pistons or packings, except the simple packings about the shaft, and the bearings are simple and self-oiling. All internal parts of a De Laval Centrifugal Pump are at once accessible upon lifting the casing cover and without disturbing piping connections and the rotating parts can be lifted out upon removal of bearing caps. All parts especially subject to wear or erosion are easily and quickly replaceable, and because of our limit-gauge method of manufacture, duplicate parts ordered by telegraph can be installed immediately without requiring to be fitted.

Every De Laval machine is tested for efficiency and proper running before shipment, and a copy of the test supplied to the purchaser, whose representative may be present at the test if desired.

Send for new Pump Catalog "B 66"

De Laval Steam Turbine Co.

TURBINE EQUIPMENT CO., LIMITED
Canadian Pacific Bldg., TORONTO, Canada
THE E. LAURIE CO.
243 Bleury Street, MONTREAL, Que.



De Laval turbine-driven pump, 2080 gal. per minute, 225 ft. head, and De Laval motor-driven pump, 2080 gal. per min., 170 ft. head, for Corporation of Brockville

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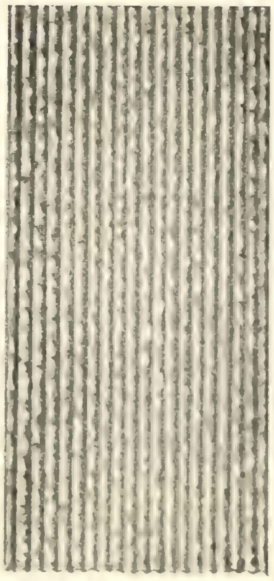
for Roofing and Siding

We know of no other Corrugated Iron in Canada that the manufacturers can give as strong a guarantee as to its lasting qualities, as we can on our Sarnia Corrugated Iron. All our products are made from the Sarnia New Process Galvanized Sheets, which possess remarkable durability when exposed to the weather, and will resist corrosion and the action of the elements to a much greater degree than ordinary steel or iron or those products based on alleged "purity" of the materials.

Standard sizes carried in stock in 24, 32, 36, 48, 60, 72, 84, 96 or 120" long x 33" wide in 18 x 20, 22, 24, 26 and 28" guage.

We also manufacture Plain Galvanized Iron, Metal Sidings, House Shingles, Ventilators, Sky Lights, Eave Trough, Conductor Pipe, Volleys, etc.

We have specially prepared literature on any of the above products, which we will gladly send you on request.



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Why Not Solve Many of Your Problems by Using an

OXY-ACETYLENE WELDING AND CUTTING PLANT?

It helps you to overcome many difficulties, and has proved to be a MONEY-SAVER and a MONEY-MAKER in the Contracting Business.

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Are Manufacturers of

MADE-IN-CANADA PLANTS
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— Factories the World over

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Our NEW BOOKLET will bring you much information.

Write NOW, before you forget.

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MONTREAL, P.Q.

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Cutting Iron Bridge at Toronto.

DUNDAS QUARRY

Capacity 4000 Tons Daily

OUR

Facilities for supplying any quantity of

CLEAN CRUSHED STONE

Are Unexcelled

SHIPMENTS — G. T. R. & C. P. R.

Team Delivery If Required

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SAND

GRANOLITHIC
TRAP-ROCK

Rogers Supply Co., Limited

28 King St. W., Toronto

MAIN 4155

8 x 8 x 24 inch Granite Rock Face Block

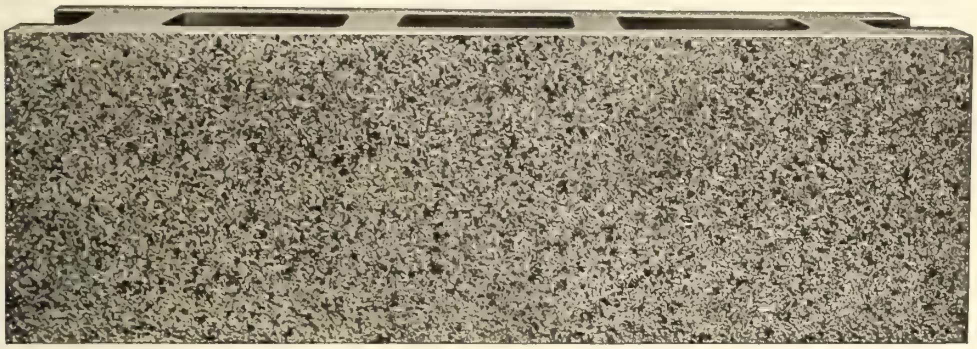
Molds for Casting

Waterproof Hollow Cement Building Blocks

With Granite Faces

THEY COST LESS — THEY SELL FOR MORE
YOU SELL MORE OF THEM

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



8 x 8 x 24 inch Granite Smooth Faced Block

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush, or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold, or moisture.

Send us fifty cents and we will send, freight prepaid, to any point in Canada, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Cast Stone Block & Machine Co., Limited **(Zagelmeyer System)**
298 Howard Avenue, WINDSOR, ONTARIO

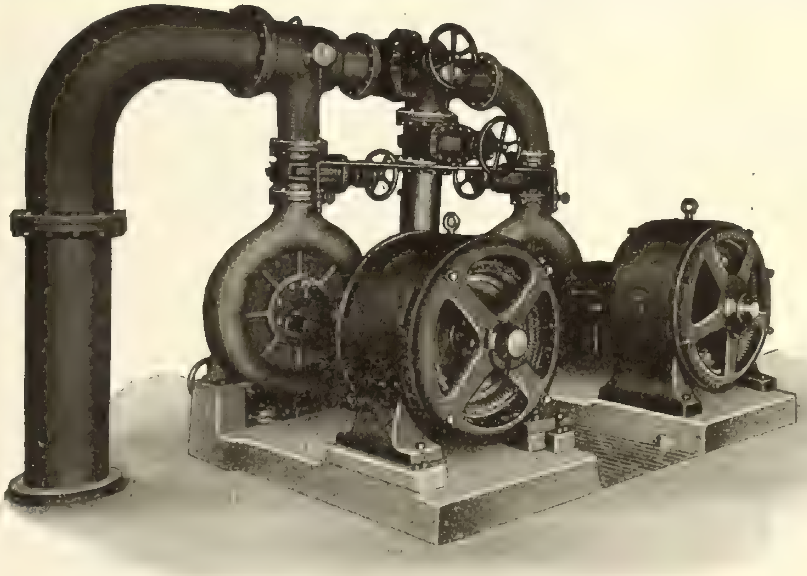
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., Montreal.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Build Your Sewers Now
And Save Money To Ratepayers

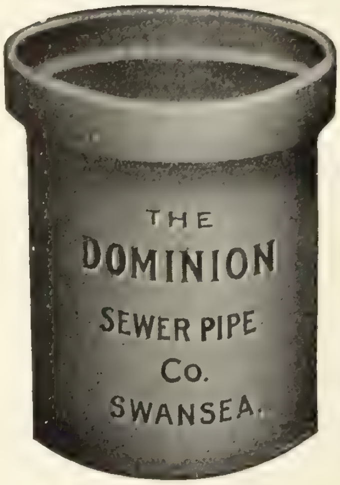
Competition is very keen in all lines right now and ours has not escaped. Contractors need work and are tendering closer to rock-bottom than they have for many years. All material has dwindled in price. So has labor.

You can save 20% to 30% of normal cost by building your sewers now. The extra ½% or 1% that money costs is swallowed up by the saving on work.

—BUY NOW—
and keep the wheels of progress turning.

The Ontario Sewer Pipe Co., Ltd.
MIMICO, ONT.

SWANSEA
Salt Glazed and Vitrified
SEWER PIPES



True to Size
Impervious to Water.

Sizes manufactured and always in stock 4 in. to 24 in.

Ask for Price List and Discounts

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Flue Linings
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Culvert Pipe
Inverts

Telephone (Toronto Connection)
Parkdale 5000

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(The Independent Co.) **Limited**
SWANSEA (near Toronto)

Town and City Sewers

In our salt glazed vitrified sewer pipe we offer the highest type of sewer material. Pipe of our manufacture have been used in practically every city in Canada. Highly glazed and perfectly vitrified.

If you are contemplating sewer construction we can quote you some attractive prices. We also make all classes of fire clay goods.

Prompt shipment on all orders.

Made in Canada with Canadian Clay, Canadian Coal, and by Canadian Workmen.

Standard Clay Products Limited

THREE SEWER PIPE FACTORIES: **St. Johns, P. Q., and New Glasgow, N. S.**
ALSO FIRE CLAY FACTORY AT ST. JOHNS, P. Q.

PEDLAR'S "PERFECT" PRODUCTS
MADE IN CANADA

The Strongest Culvert Made

Weight for Weight, **Pedlar Culverts** are the **strongest** made. Length for length, they are the **heaviest** of any corrugated culverts. Made in all sizes from 8 inches to 84 inches in diameter, and shipped assembled in lengths up to 40 feet—coupling bands supplied for longer lengths.

PEDLAR'S "PERFECT" RIVETED CULVERTS

are made of anti-corrosive TONCAN heavily galvanized, and being thoroughly tested are warranted to stand up under all kinds of climatic conditions.

When two or more sizes are ordered, at the same time, the smaller sizes may be nested inside the larger for convenience in shipment. Easy to haul, easy to install—and once installed the job is **permanent,** no maintenance required.

Write for complete Culvert Reference Book No. 4 "C. R." giving drainage tables and full data as to sizes required to handle various flows of water. Address branch nearest you.

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ESTABLISHED 1861 (4-R)
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"18" 3/4-yd. Traction Revolving Shovel, with horizontal type hoisting engines. Independent steam steering engine operated from either side of shovel; also hand steering device.

Full submerged tube type boiler built to pass inspection in all Canadian Provinces.

Shovels in stock for immediate shipment.

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(Continued on Page 14)

Easily Operated by One Man

THE G & G Telescopic Hoist Model A illustrated, makes it possible for one man unaided to perform the entire operation of raising ash cans to sidewalk and lowering empty cans to cellar.

The G&G PATENTED Telescopic Hoist
with compound gear and brake attachment

Made
in
Canada

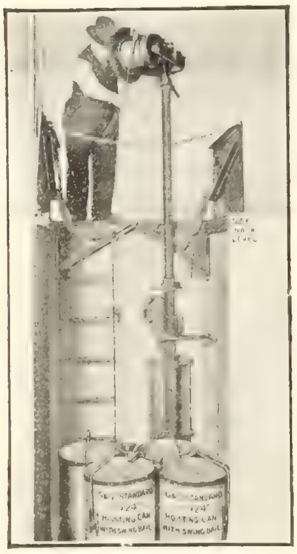

Illustration also shows the G & G Sidewalk Door Opening and Closing Device which automatically opens and closes doors as hoisting head is raised or telescoped.

Raises a maximum load of 500 lbs. at a guaranteed speed of 30 feet per minute.

When not in use hoist telescopes and no part shows above street level.

It is fitted with a patented "silencer" that makes it practically noiseless in operation.

Operates from sidewalk level—protecting public from danger of unguarded open hatch and protecting operator from injury should anything fall into hatch.

Every hoist is subjected to thorough working test before shipment.

Write to our nearest agent for new booklet and prices

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"MADE IN CANADA"

TRADE **CHAMPION** MARK

ROCK CRUSHERS

The frame of a rock crusher is subject to a tensile or pulling strain, and as forged or rolled material is the only material that is absolutely safe under such a strain, the main frame of all CHAMPION ROCK CRUSHERS is made from high carbon special rolled steel plate, which makes it entirely safe from the secret flaws common to any "cast" material.

Careful construction means long life and it is with this end in view, that the smallest detail in mechanical construction is thoroughly gone into and carried out, so that the completed machine is not only simple in construction but safe and durable in operation.

CHAMPION ROCK CRUSHERS are used in both stationary plants or mounted upon trucks where a portable plant is desired.

A full and complete line of STONE, SAND, and GRAVEL ELEVATORS, SCREENS and all ACCESSORIES.

"Ask for special Bulletin."

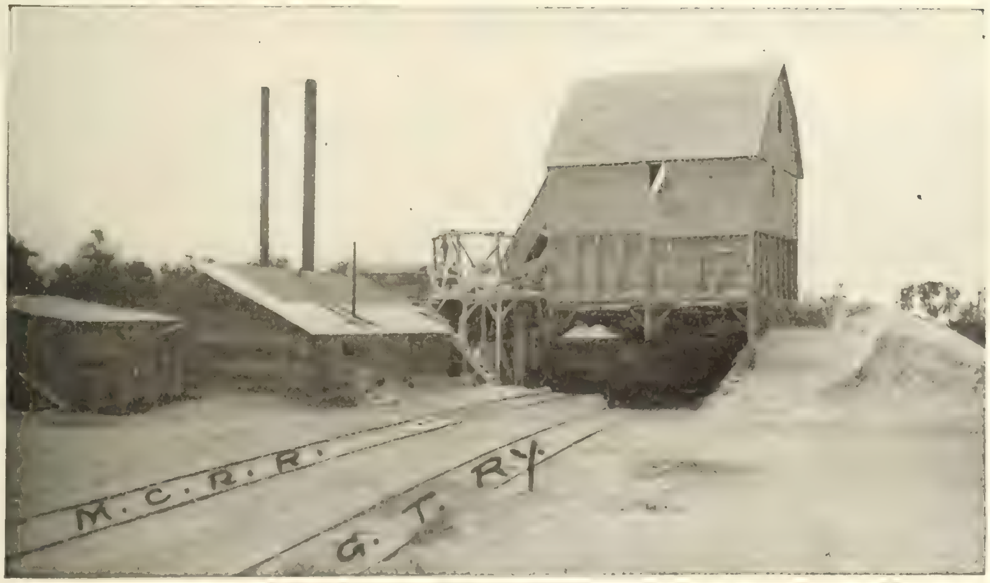
THE "CHAMPION" LINE OF ROAD, STREET AND CONTRACTORS MACHINERY.

THE "CHAMPION" OIL DISTRIBUTERS FOR DUST PREVENTION OILS, ALSO THE HEAVY ASPHALT AND TAR PRODUCTS FOR ROAD BINDERS.

Manufactured by

The Dominion Road Machinery Company, Limited
GODERICH, ONT.

Macadam Roads



must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Browning Company
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Hopkins & Co., F. H.
Marsh & Henthorn, Limited

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Canadian Fairbanks-Morse Co.
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Hamilton Mfg. Co., Wm.
Hopkins & Co., F. H.
Inglis Company, John
Laurie Company, E.
McDougall Caledonian Iron Wks.
Smart-Turner Machine Co.
Turbine Equipment Company

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Rock & Power Machinery Co.

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"FLUXPHALTE" is as easily applied as any binder and gives far better results.

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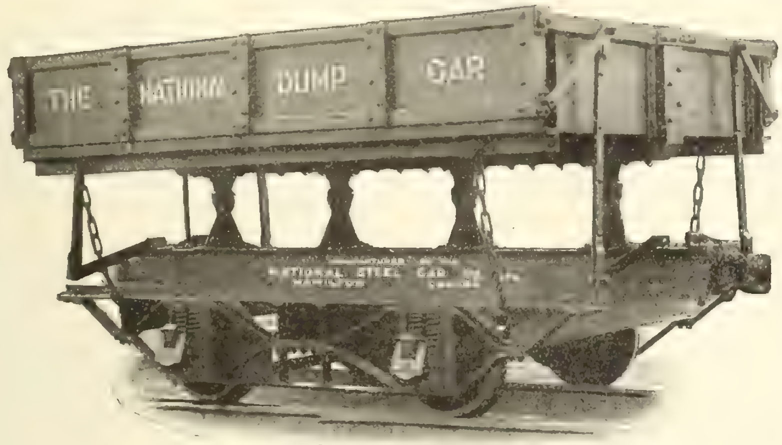

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There is no better dump car made than the "National" and it is essentially a Canadian product—every casting is poured in Canada. Repair parts are available on shortest notice. No duty to pay on car or extra parts. Our Service Department is anxious to help you to improve your equipment.

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on Bridges, Viaducts, Fences, Signs, Hand-Rails, Lamp Posts, Ornamental Iron Work, etc., should be protected against rust and corrosion by Toch Brothers'

No. "R. I. W." 49

REMEMBER IT'S WATERPROOF

DAMP RESISTING PAINT

This material has been used in every part of the world on steel and metal work, and forms a firm, elastic coating that resists the corrosive action of locomotive gases and fumes of any description far better than oil paints. It should be used wherever metal surfaces are exposed to acids, fumes, gases, etc., or the elements. No. 49 "R. I. W." has a generous covering capacity and dries with a black enamel-like finish. Can also be furnished in dark olive green.

REMEMBER —— Steel need not rust!
Wood need not rot! Nor concrete "dust"!

Write to nearest distributor for copy of Red Book

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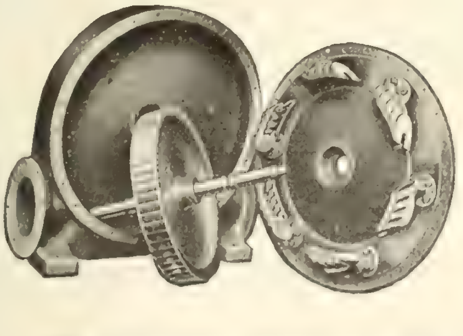
"Getting the Lid Off"



STURTEVANT STEAM TURBINES are made **"accessible."** All inspections and adjustments can be made from the OUTSIDE. For this reason the Sturtevant Turbine need scarcely ever be taken down.

BUT—"Accessibility" must be distinguished from "getting the lid off" such as is done in a horizontally split casing. The ability to "get the lid off" is all right for turbines that need constant attention, but for a turbine that's made to run —like the STURTEVANT—a vertically split casing is unquestionably superior.

In the very infrequent inspections which are necessary with a STURTEVANT, it requires **only twenty minutes** to split the casing—not much chance for losing time there, is there?

This operation enables you to inspect and touch every internal part instantly. The nozzles and other essential parts are not hidden away in inaccessible parts of the casing.

That's the great distinction between "Getting the lid off" and "Accessibility."

The Sturtevant Steam Turbine has a vertically split casing and is "Accessible."

Catalog No. 210-Z describes it.

Sturtevant
(REG. CAN. PAT. OFF.)

B. F. Sturtevant Co. of Canada, Ltd.
Galt, Ontario
Montreal Toronto Winnipeg Vancouver

Selling Agents for the Sanford Riley Stoker, the "RILEY STOKER."

A perfect brick with a popular, distinctive color —RED.

Those are our two great specialties underlying the success of

"PRESSED BRADFORD BRICK"
(TRADE MARK REG. U. S. PATENT OFFICE)

"BRADFORD REDS" stand out in the history of brick-making—have become the standard red brick of North America. Their rich cherry red color and their uniform high quality have caused them to be specified all over the continent, in spite of price or distance.

"Bradford Ruffs"—A rough-textured red brick of exceptional merit in building bungalows, garden walls and creating unusual effects of various kinds.

Write for the RED Catalog.

Bradford Pressed Brick Co.
"The Red Brick People"
Bradford, Pa.

We also make Fire-proofing, Hollow Brick and Hollow Block.

KERR

Gate Valves
and
Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO

ENGINEERS WANT WIRE-CUT-LUG

Experience and Observation have Convinced Eminent City and County Engineers of the Superiority of Wire-Cut-Lug Paving Brick.

READ THESE TESTIMONIALS:

Mr. R. Keith Compton, Chairman of the Paving Commission, of Baltimore, which city is repaving all its streets and alleys, said on April 5th:

"Wire-Cut-Lug block have given entire satisfaction in this city. We have used the same on the majority of our brick streets since the early part of 1913. At this time we are using Wire-Cut-Lug almost exclusively."

Wm. M. Acheson, Division Engineer, New York State Highway Department, with headquarters at Buffalo, on April 12th said:

"Dunn Wire-Cut-Lug brick used on work in this Division has given satisfactory service—both from a construction and wearing standpoint."

Niagara and Erie Counties, New York, which are in Mr. Acheson's Division, have nearly two hundred miles of brick pavements.

Mr. D. Moomaw, Road Engineer of Cuyahoga County, Ohio, in which County there are three hundred miles of brick pavements, says under date of April 5th:

"Brick roads in Cuyahoga County are now being constructed largely of Wire-Cut-Lug brick. . . . . I am convinced of the superiority of Wire-Cut-Lug brick over repressed. By having the more suitable bonding surface on the sides of the Wire-Cut-Lug brick the cement grout filled pavement produces a wearing surface of much greater slab strength than we have formerly obtained."

Mr. W. A. Stinchcomb, County Engineer, of Cuyahoga County, Ohio, says:

"As to our experience with Dunn Wire-Cut-Lug brick I wish to state that it has been very satisfactory. In fact, we have encouraged contractors on work that was let before the Wire-Cut-Lug brick came on the market, to substitute Wire-Cut-Lug for the repressed. Our experience is that we are able to prepare a much better bond by the use of this brick than with the repressed."

Mr. D. R. Lyman, Chief Engineer, Louisville, Ky., writes:

"We have been laying Wire-Cut-Lug vitrified block in Louisville for about two years and are very well pleased with results obtained. We have always used cement filler with Wire-Cut-Lug blocks and in this class of construction I think Wire-Cut-Lug blocks are superior to repressed blocks on account of the square edges and better density. In general we have secured better results with Wire-Cut-Lug blocks than with repressed blocks and I hope we will be in a position to lay a greater yardage of Wire-Cut-Lug blocks in the future."

Twenty-six independent competing companies, operating forty-two plants and having an aggregate annual productive capacity of 500,000,000 10-pound brick, make Wire-Cut-Lug paving brick.

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United Brick Company, Greensburg, Pa.
    Plant at Conneaut, Ohio.
Sterling Brick Company, Olean, N. Y.
Reynoldsville Brick & Tile Co., Reynoldsville, Pa.
Danville Brick Company, Danville, Ill.
Clinton Paving Brick Company, Clinton, Ind.
Alton Brick Company, Alton, Ill.
Deckman-Duty Brick Company, Cleveland, Ohio.
    Plants at Cleveland, Carrollton and Malvern, O.
Tuna Valley Pressed Brick Company, Bradford, Pa.
Foster Paving Block Company, Bradford, Pa.
    Plants at Bradford, Pa., Binghamton, N.Y., and Youngsville, Pa.
Metropolitan Paving Brick Company, Canton, Ohio.
    Four plants at Canton, O., one at Willow, O.
Bessemer Limestone Company, Youngstown, Ohio.
    Three plants at Bessemer, Pa.
Peebles Paving Brick Company, Portsmouth, Ohio.
    Two plants at Portsmouth, Ohio, one at Firebrick, Ky.
Murphysboro Paving Brick Co., Murphysboro, Ill.
Southern Clay Mfg. Company, Chattanooga, Tenn.
    Plants at Robbins, Tenn., Coaldale, Ala.
McAvoy Vitrified Brick Company, Philadelphia, Pa.
    Plant at Perkiomen Junction, Pa.
Windsor Brick Company, Akron, Ohio.
Hocking Valley Brick Company, Columbus, Ohio.
    Plant at Logan, Ohio.
Veedersburg Paver Company, Veedersburg, Ind.
Springfield Paving Brick Company, Springfield, Ill.
Terre Haute Vitrified Brick Co., Terre Haute, Ind.
Albion Vitrified Brick Co., Albion, Ill.
Alliance Clay Product Company, Alliance, Ohio.
Westport Paving Brick Company, Baltimore, Md.
Mack Manufacturing Company, New Cumberland, W.Va.
    Four plants at New Cumberland, W. Va.
The Hydraulic-Press Brick Company, St. Louis, Mo.

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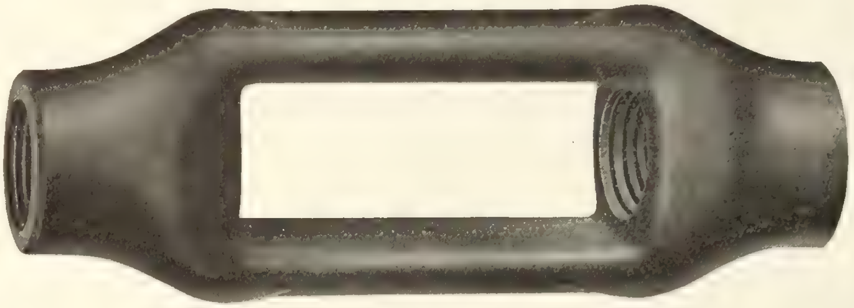
THE DUNN WIRE-CUT-LUG BRICK CO. (Licensors) Conneaut, Ohio

Standard Turnbuckles

Made in Canada

All Sizes in Stock



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Limited

Welland, Ontario

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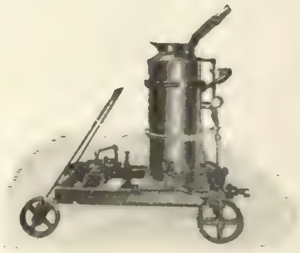

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Because:

Gunite is water-proof and denser than any concrete.
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No forms are required.
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Gunite is being specified on a large percentage of jobs. Where Gunite is not specified a Gunite alternative submitted will allow a lower bid and hence make your proposal more liable for acceptance.

If you will send us an outline of your problem we will be pleased to submit Gunite specifications, cost data, references, etc.

Cement Gun Company, Inc., New York

ESTABLISHED 1888

Contract Record and Engineering Review

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Patriotism in Awarding Contracts

PATRIOTISM is of various kinds, and it has been defined in a number of ways. Webster's definition is "devotion to the welfare of one's country," but a writer of lesser vocabulary, but greater perspicacity, perhaps, has defined patriotism as "the last resort of a scoundrel." There is a patriotism that consists of great words, and there is a patriotism that finds its only expression in great deeds. The former is forgotten; the latter becomes part and parcel of history.

There are certain things which are almost forgivable in times of peace, when something is needed to relieve a nation or a people from the comparative stagnation of some of the higher qualities which prolonged freedom from conflict of any kind engenders; but these things at a time when a nation or a people is struggling for its existence are unforgivable.

As a rule, business and sentiment have little in common, but this great world-war in which the Empire is engaged provides the exception, and in all decency business to-day must be clothed at least with an outer garment of patriotism. To ignore the interests of one's people at a time when one of the most vital considerations of the country is to maintain business stability is to show a lamentable lack of true patriotism. All of which is introductory to a brief comment which we desire to make upon the action of one of Toronto's leading departmental stores in awarding the contract for an eight-storey warehouse at Regina to a Chicago firm. Our attention has been called to this matter by a number of prominent contracting firms, and we do not hesitate to express our disapproval of the action of The Robert Simpson Company—the Toronto firm to which we refer above.

The experience of a prominent Winnipeg contractor as communicated to this journal is interesting. When our correspondent heard that the Simpson Company had decided to build in Regina he wrote to their head office in Toronto asking for the privilege of tendering on the work, and offering to furnish satisfactory references as to his experience on large contracts. He received a reply thanking him for his proposal, and stating that the Simpson Company's representative, who was then in the West, would call on him—which he did several weeks later. When he called on the Winnipeg contractor he informed him that tenders for the Regina building closed on the following Monday. The explanation was forthcoming that it was first the Simpson Company's intention to give the work to an eastern contractor who had done satisfactory work for them previously, but later that it had been decided to allow three Regina contractors to figure, and that these would have the preference.

Owing to the shortness of the time, and to the explanation as to the local preference, the Winnipeg man decided not to go to the trouble and expense of making up a tender.

In another instance a Winnipeg contracting firm capable of carrying out work of any size, particularly in this class of work, was not given the opportunity to figure.

The Simpson Company secured concessions from the city of Regina on the understanding that they would erect a building and establish a branch there, and the first step they take is to give preference to outsiders, who will bring in outside foremen, and spend their profits in the United States.

Now there is no reason in the world why United States contracting firms should not come into Canada and get business—if they are able to do so in fair competition; but without open competition, and such publicity being given to the work as will enable all thoroughly competent and financially able Canadian contractors to tender, to send Canadian important contracts across the border at a time when constructional enterprise in the country is at such a low ebb is little short of treason. The offence is particularly aggravated coming from a firm that has derived its profits from the departmental store business—generally from the hard-earned purchases of the man or woman in the street—the man and the woman whose interests every properly constituted business enterprise, in common with the State itself, should have at heart.

One cannot refrain from hoping that The Robert Simpson Company's latest venture in the West will be attended by scant success. Of all things that we love, it is consistency; and it is such a gross outrage upon consistency—and upon decency—for a departmental store to make its money out of the Canadian people and spend it in the United States that we cannot find it in our heart to take a charitable view of the offence. At a time when Canada and the Empire have vital need of all the internal business developed within the country—at a time when British lives are being laid down by thousands in the cause of Empire—there can be nothing urged by way of palliation.

Montreal Water-Works—The Need for an Expert Investigation

As reported in our issue of Agust 11, the Council of the Canadian Society of Civil Engineers have unanimously asked the city of Montreal to appoint an independent board of engineers to study the proposed further expenditure on the Montreal filtration plant, aqueduct, hydroelectric scheme, etc. The original plans have been gradually altered and enlarged until the scheme has taken on a different aspect; the expenditure, too, has been added to at quite an alarming rate, and the end is by no means in sight. The cost may be ten millions, or eleven, but the scheme has been built up in such a piecemeal fashion that the total expenditure is still in doubt. Owing to the method by which extensions have been made, we understand that the entire scheme has not been reported on by any engineer. There have been reports on the original plans, reports on the conduits, reports on various other sections, but a real comprehensive report on the whole undertaking, including a proposed fresh expenditure of over four millions, has yet to be made. Some of the reports in favor of the plans were almost ancient, and one of the past presidents of the Canadian Society of Civil Engineers, and whose name has been publicly used in support of the project, publicly repudiated the use of his name to support the scheme as it now stands.

Apart from the design of the retaining walls, which are to be strengthened as the result of a wall constructed for test purposes, the chief objection is to the portion of the scheme dealing with the proposed hydroelectric development to give 10,000 horse power for pumping and lighting purposes. In February, 1914, Messrs. J. A. Jamieson, R. S. Lea, and G. R. Heckle, in reporting on the water supply conduit, made a most emphatic recommendation that a board of engineers be appointed to investigate the aqueduct section, including revised estimates of the cost of construction and the quality and cost of the power developed. Nothing was done, but in place of it are recommendations to spend large sums on installing the necessary equipment for a power station. It is contended that the enormous expenditure will mean that the city will be paying interest charges alone, to say nothing of working costs, which will be many times more than the price at which electricity can be purchased in the city. This will be a heavy burden on the city, and competent engineers believe that this is unnecessary and that a considerable saving could be made.

The Canadian Society of Civil Engineers argue that the only way to get to the bottom of this matter is to have all the facts investigated by an independent board of engineers; there is at present no sign of the Board of Control acquiescing in this suggestion—Mr. Controller Cote says it is an efficient and economical scheme—but we believe that the Society will follow up their recommendation in order to bring the weight of expert and public opinion on the Board of Control. There is a want of confidence on the part of engineers as to the business methods of the city of Montreal, and the events of the last few months in relation to the giving of contracts for paving go a long way to justify their scepticism as to whether the water-works scheme is not another of the civic muddles. Any doubt as to the value of the scheme, whether from the engineering or financial standpoints, can be easily set at rest by appointing men of undoubted ability to investigate the entire project. If it be as satisfactory as the city suggest, then the public will be satisfied that they are spending money on a reasonable proposition, but if the scheme be found impracticable except at an excessive cost, the few thousand dollars spent on the inquiry will be money well laid out, for it will prevent the expenditure of many hundreds of thousands on a plan which is unsound.

A Dangerous Precedent

A clerical error in a bid submitted is a frequent cause for controversy between the contractor and the owner. In some cases the error may be so large that a forfeiture of the bidding deposit is the cheapest way a company can get out of the situation, if the owner is willing to permit this expedient without suit for added cost of construction. In other cases, the error is small enough so that the company can afford to go through with the contract and accept the reduced profits. In a few instances, the owners will allow the contractor to correct his clerical errors and submit a revised bid.

A case of this kind has recently arisen in an eastern city where a contracting firm recently submitted the lowest bid on a sewer contract, a bid nearly $17,000 lower than any of its competitors on a $58,000 contract. The contract had been awarded to this company, when it was discovered that clerical errors in figuring manholes, walks and other accessories, had made their bid $1,240 too low.

The president of the contracting firm then called the attention of the city authorities to the error and asked leave to correct it. The great difference in the bids of this company and the next lowest bidder, as compared with the amount of the error, caused the city authorities to allow the correction of the bid and, instead of $56,886, as originally submitted, the contract was made out and signed with the amount set at $58,126.

We do not believe that this is a good policy for a municipality to follow. It establishes a precedent in matters of this sort which may prove decidedly dangerous. A contractor might conceivably submit a bid with known "clerical errors." If the bid were low enough to secure the award with these "clerical errors" corrected, the contractor could call them to the attention of the city and have his bid raised. If the bid barely won out over a competitor, nothing would have to be said about the errors, but the bid as submitted could be allowed to stand.

Such a possibility would give an unscrupulous contractor a chance to impose on the municipality and would be decidedly unfair to other bidders. It should be a firmly established rule that a bid submitted cannot be altered in any way whatsoever. A contractor should prepare and check his bid so carefully that there is no possibility of a clerical error and should then be compelled to stand by the bid submitted or else forfeit his certified check and accept whatever other legal action is taken. So far as we know, the action taken in the individual case cited was fair enough, but as a precedent established it must be severely condemned.

Can "Good Times" in America Come from the War in Europe?

The U S. Viewpoint as expressed by Engineering & Contracting, Chicago

MANY political economists have answered this question in the negative. They are of the school that reasons that any large "destruction of wealth" in any part of the world inevitably reacts unfavourably upon wealth production in other parts of the world. But it is noteworthy that they rarely define "destruction of wealth." The fact is that nearly all wealth is "destroyed" almost as soon as it is created, if by "destruction" is meant consumption. Hence an explosion of ammunition is a "destruction of wealth" that does not differ essentially from the wearing out of a silk dress or the drinking of a cocktail.

A very small percentage of the wealth produced annually is added to the world's stock of wealth. This stock is capital, and is largely used as an instrument for producing more wealth. To destroy capital in large quantities may very well lead to the impoverishment of its owners, but to destroy wealth not used as capital is quite another matter.

A comparatively slight amount of the world's capital has thus far been destroyed by the great war, and there is no likelihood that any considerable percentage will be destroyed. It is important to bear this in mind when discussing the probable effect of the war upon America.

Any great sudden change in the productive energies of a nation must inevitably absorb other nations temporarily. It is not "destruction of wealth" that causes such disturbance, however. The real trouble arises from the hesitancy of business men to change their lines of output, or to continue their normal output in the face of uncertainties as to markets. But as time passes, business leaders begin to modify their action to suit the conditions, and "times revive." This revival has been happening in America at a very rapid rate during the past six months.

The textile trades, the metal industries, grain farming, and many other industries have shown marked growth. Consideration makes it apparent that the revival will continue and will spread to other industries.

The war has diverted the energies of millions of men from the production of utilities that were formerly exported to us. America must, perforce, either go without those utilities or proceed to produce them herself. She has done both. There has been some economizing and there has been some enlargement of home production.

Our exports have necessarily changed considerably in character, but they have grown to such proportion that the ensuing twelve months seem likely to yield a balance of trade amounting to $2,000,000,000 in our favor. The effect of this will be to cause a flow of gold to America, slow at first but greater when the war ends. This will cause a rise of prices in America. It will also result in our purchase of American securities now held by Europeans. Neither of these occurrences spells financial depression. So long as prices are rising it is wise to invest in plants capable of producing income, and it is relatively unwise to invest in bonds. Hence in times of rising prices men expand their investments in plant, supplies and goods.

The transfer of American securities from Europe to America will itself result in increasing the permanent supply of cash capital, for interest and dividend payments will flow in diministed stream abroad. Our exchange of products for these securities will therefore tend to increase prices here by decreasing the annual flow of gold to Europe. And, as just stated, an era of rising prices is an era of "good times," for it leads to aggressive action by investors and business men.

The close of the war will cause another readjustment, but this time not in an atmosphere of gloom. On the contrary, the spirits of all Europe will rise. Optimism will give impetus to every trade. "But," argues the school economist, "how can there be revival where debts bow men's backs to the dust?" Debts to whom? Mostly those of the government to its own people, and this means the debts of citizen A to his neighbor B, and of B to A. The rich and well-to-do may suffer most as a result of war taxes, but this is by no means certain, for it is they who hold most of the bonds issued by the government. They will have economized during the war sufficiently to have paid a large part of the cost of the war. The instruments of production will have remained uninjured, for the most part. Men will man them, and history will repeat itself in showing "an amazing industrial recovery"—amazing chiefly because we are so accustomed to regard war as a great destroyer of capital, which ordinarily it is not.

Men by the millions will have died. Will this cripple European industry? Not for long. This war, nearly all thinkers agree, is really a struggle for industrial supremacy. If so, it means but one thing—an overcrowding of Europe with workers whose wares do not find ready markets. Already reports are reaching us that English workmen are enjoying prosperity such as few of them have ever tasted. Cruel as the process of extermination of men is, the men that are left are apt to be better off than if no extermination had taken place. This heartless condition is not the ideal toward which the world moves, but is none the less a present fact that we cannot ignore.

A great war is a great stimulus to actions of many sorts other than military as well as military. It shakes even the somnolent type of mind into wakefulness. Many it kills but many more it cures. Our civil war served to develop thousands of young men into self-reliant and ambitious leaders who afterward made their marks in the halls of industry. This is seemingly one of nature's compensations for tre sacrifices of battle.

While we do not indorse war as a thing to be desired, as some have claimed it is, we may well take comfort in the compensations that it brings—and they are by no means negligible. To America the gains are, by all odds, greatest. This is bearing home upon our attention already. We shall see still greater commercial benefits with the passage of every month, and they will not cease when the war ends.

"Inaccuracies" of the Press

IN the smaller cities—and, for that matter, in the larger ones also—there is lamentable carelessness in the recording of engineering details. At best, the handling of technical data and figures by men of no special training can be only a makeshift. So that when there is a strong suspicion of misrepresentation into the bargain the situation becomes intolerable.

An instance of this has just occurred at Berlin, Ont., where a section of the local press has been endeavoring to place upon the City Engineer the blame for certain defects in the sewerage system. In support of its arguments it was reported in a leading editorial that the estimated cost of repairs found necessary by the consulting engineer, Mr. Willis Chipman, was $6,500, whereas the actual amount was **$65.**

It is strange that a typographical error of such an extraordinary character should occur in the editorial column of a paper which throughout had been putting the local engineer in the worst possible light. At best it is a wretched coincidence; at worst it is suggestive of the kind of malevolence which would be deserving only of contempt were it not for its misleading effect upon the public and its injustice to the engineering profession.

Are Architectural Competitions a Mistake?

THERE seems to be a growing feeling among architects that competitions are a mistake; and the architectural profession may certainly take it that members of professions outside their own think so too, for it is hard to understand why this profession should, to the extent it is, be subjected to the hardships inseparable from a competition. That there are hardships scarcely needs pointing out. In the first place, the chances are greatly in favour of the man in large practice, because he either maintains a large staff or can afford to engage a special staff for a competition; he can use the combined skill of all this staff, merely supplementing it with his own, to turn out his design, while a man less favorably placed has to do practically the whole work, mental and mechanical, unaided. In such circumstances the balance of advantage clearly lies with the first, just as it would in a race where a machine of small horse power is in competition with one of much greater capacity. The unfairness of it between man and man is thus inherent in every competition. Then as to the effect on the work produced there is this to consider. Conditions have to be laid down more or less rigidly which all competitors must observe. The designer may see a way of ignoring some of these and by so doing vastly improving his design, but he dare not, nor dare his client, if consulted, agree to his doing so, because if he did he would be unfair to the other competitors. It will happen sometimes, however, that a bold step is taken, a condition, or two, is evaded, and a design is produced that by its intrinsic merits captures the client or assessors. They would probably refuse to sanction the change, if asked beforehand; but if it is made without their being asked and is perceived at the same time as the improvement effected comes before them, they are disarmed and are apt to condone it. But a step of this kind can be taken only by the experienced competitor. He has learned how much rope the average assessor may be expected to allow and boldly goes the full length of it, while the less experienced man is too timid to take an inch of it. And here again the latter suffers from a certain degree of unfairness. It is usually said that a competition calls out a man's best efforts; but we think for more than one reason that this is a doubtful assumption. When a man is taken from work on which his daily bread depends to embark on what to him is a mere speculation in which his chances of success are in most cases remote, is he likely to put his best into the speculative work? One with the spirit of the gambler might, but the man of sober and earnest mind is more likely to feel towards his competition work as one feels towards the lighter occupations of life, something to be taken up lightly when the real day's work is over, something in which no high hopes are centred and therefore for which his highest efforts are not reserved. This, we take it, is the spirit in which competitions are entered upon by all except the sanguine few who have been endowed by nature with energies sufficient to be devoted equally to the shadow and to the substance. When, again, a man is engaged upon a competition he is, humanly speaking, bound to consider the idiosyncrasies of the assessor, or the principal one of the assessors when there are more than one. Assessors are men naturally well known in the architectural world; from their own works their tendencies can be judged, so the discerning competitor is extremely likely to put on one side some of his own originality if he can produce in its place work that is likely to please the individual by whom his work is to be judged; and so his work is not as free as it otherwise might have been. In a system under which a client comes to an architect, tells him in a general way what he requires, definitely makes over the work to him, and is accessible for consultation at every stage of the design, we cannot help thinking much better work can be produced. The completed design may differ materially from what the client had in his mind when he set out to engage his architect, but it is certain to be better. His essential requirements will havt been met and probably something more; it is even possible that economy has been secured by more skilful disposition.

Looked at broadly, a competition is a great waste of skilful effort. It is true the prize, or prizes, given may be of higher value than is the professional value of the individual design, or designs, to which they go. They never, or seldom, represent the professional value of all the designs submitted, and thus the client has received more than fair value for what he has given. He has called forth a large amount of work for his own benefit for which he has paid nothing and which is worthless for any other purposes, and has thus been the cause of much wasted labour. The difference between a competition and a lottery is, after all, but small; in the second the stakes are in money, in the first they are in labour. It is true that the one is a gamble whose success depends on chance, the other is one whose success depends on skill; but there are elements which handicap the skill of some of the competitors, and there is an element of chance in the decision of those who select the prize winners. If then there are any advantages in architectural competitions, they lie on the side of those who invite them; but we are speaking on the side of the competitors, and in their interests we feel that it would be well if competitions were abolished. Nothing of the kind prevails in any other profession, except in a very limited way in engineering, and the architectural profession would gain in dignity if it proscribed them.—Indian Engineering.

The Elements of Accurate Cost-Keeping[*]

By Edward Probert

THE introduction of a cost system will substitute accurate knowledge for guesswork, and will facilitate the adoption of more consistent policies. With accurate knowledge of conditions, there comes an incentive to excel them, and this is always a desirable condition of affairs.

Accurate costs will reflect fluctuations in the prices of raw materials, labor and expenses, day by day, week by week, year by year, enabling the management to meet competition intelligently, because, when preparing estimates, they have authentic data as a guide.

By analysis and comparison, the cost system will develop a knowledge of the weak spots in the organization, bringing them to the attention of the management, for the closer the transactions of a business are analyzed and sub-divided, the fewer opportunities there remain for leaks and waste.

The managing officer, through the cost records, can determine whether men or methods are rendering efficient service, and, by having definite figures showing the cost of each operation, each operation can be analyzed to see whether the cost cannot be reduced by a better method.

One reason why cost systems are not more extensively used, is that, to the uninitiated, they appear a mass of hopeless detail, yet, when fully understood, each detail is seen to be a vital important part of the whole.

Summarizing, the general advantages of a cost system are: (1), reduction of costs; (2), increased output; (3), introduction of machines to replace manual labor; (4), guide for future estimating; (5), basis on which to judge the efficiency of men and methods.

Uses of a Cost System.

Cost records should be made, not only for the purpose of determining profits after the job is completed, but also with the object of discovering opportunities for economy. It is not enough to know how much a job costs; it is most essential that the contractor should know why it costs as much as it does. Then, if the unit costs are higher or lower than on previous jobs, the records should enable the portion of the work in which the difference exists to be promptly and accurately discovered.

A cost system must be constantly used to be of any benefit. A contractor would not buy a steam shovel, run it on a spur at the job and expect it to remove the dirt without attention of any kind.

Some of the things a cost system should do are: (1), determine the labor, material and expense cost per unit on each class of work; (2), give a record of the man-hours per unit on each class of work; (3), show the condition of the work on each unfinished group; (4) show the total amount of direct and indirect labor on each job, and for what the indirect labor is used; (5), show total output, average monthly output, busy time, and idle time on each group, for day, week or month; (6), show operating cost per hour, and per unit handled, of each class of machine used; (7), show whether unit costs are increasing or decreasing; (8), reveal attempts to cover mistakes or weak conditions; (9), disclose wastes of time, of material and of expenses.

Elements of Costs

Costs cannot be determined by the use of exact mathematical formulae, such as are used in the solution of the majority of engineering problems. If five engineers or five hundred are asked to give the formula for maximum bending moment for a uniformly loaded simple beam of uniform cross-section, they would all concur in the statement $\frac{wl^2}{8}$, because the formulae for the investigation and design of beams are based on inexorable natural laws.

The various elements that go to make up the cost of a job, however, can be grouped under different headings and their relation to each other can be stated by the following approximate formulae:

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[*] Abstract of a paper prepared for The American Society of Engineering-Contractors.

Direct Labor + Material + Direct Job Expense= Job Cost.

Job Cost + General Expense = Cost to Construct.

Cost to Construct + Selling Expense = Total Cost.

Total Cost + or — Profit or Loss = Selling Price.

These are the main divisions, although, if a number of accountants were asked for their definitions, they would designate them by different names; for, unfortunately, the terminology of accounting has not reached the same degree of fineness as that of the other professions.

The items of time, material, and expense occur in every business, whether it is the making of needles or the building of a four track railroad from the Atlantic to the Pacific. The problem lies in tracing and apportioning time, material, and expense, which make up the total cost of doing business.

The mere grouping of items under general headings, however, is not sufficient. For instance, it is the practice of some contractors to promiscuously group under one heading all the items of labor, material and expense used in placing the concrete on an entire building job, then divide the total amount by the total number of cubic yards placed, and say that the concrete costs so much per cubic yard.

This does not give an intelligent cost. It does not allow comparison with other jobs, which have had more or less masswork, larger or smaller columns, beams and girders, richer or poorer concrete, different reinforcement and numerous other variable factors. Its use in estimating on future jobs would be accompanied by misgivings as to whether the conditions on the new work are in any way similar to those on the old job. It is obvious that the above so-called "cost" would be of no value for use in estimating the cost of retaining walls, dams, or other masswork.

A specific instance of this came to my attention quite recently. The contract covered all the concrete work in connection with the erection of a new plant, to cost approximately $50,000. The work consisted of footings, foundations of various depths, a concrete reservoir, a concrete pit 25 ft. deep under the pump house, piers, machinery foundations, columns, etc. The contractor obtained the job at a low blanket price per cubic yard, which showed clearly the earmarks of "rule of thumb" estimating. After receiving his final estimate and selling his entire plant, the contractor managed to pay his labor and material bills, but had to borrow money to pay his railroad fare home, minus profit, minus plant, plus experience.

If this contractor had had dependable cost records, which would give unit costs, divided into labor, material, and expense, there would have been a different story to relate.

Devising a Cost System

The most important feature in devising a cost system is to see that it is peculiarly adapted to the individual contractor's business. It must be complete yet simple, exhaustive but not cumbersome, absolute and still flexible, and, above all, free from red tape.

In the designing of a thorough system, a knowledge of the fundamental principles of accounting science and some familiarity with its practice are necessary. Equally important are a knowledge of field work, a thorough study and analysis of conditions, a clear understanding of the essential features of the business and the manner in which the final results should be reported. Given these essential qualities, the best system will be one that is based on an extensive knowledge of the organization, operation, personnel, strong and weak points and aim of the specific undertaking for which the system is intended.

A cost system to be complete should include every item of expenditure connected with a job or jobs from the time that the bid is accepted until the final release is signed. It should be a complete and accurate record of actual transactions and should not contain data based on approximations, guesswork or speculations, for then it becomes only a process of recording human guesswork.

The system must be designed to fit in with the regular routine of the work and not, as is often the case, to handicap the work by trying to adapt it to the requirements of system, transplanted in whole or in part from what some other organization is using. One of the fundamentals upon which the total success of the system is dependent, is that it must be attuned to the particular needs of the organization. Too much emphasis cannot be laid upon this feature.

There are cost systems and costly systems, the first giving an abundance of useful data with comparatively little work, the latter giving comparatively little data with an abundance of work.

A system should be well balanced, i.e., the different classes of work should receive consideration according to their relative importance or their proportion of the total amount of the work. It is absurd to devote a lot of time to calculating the cost of some part of the work to one hundredth part of a cent, when the total cost of that work is only one-tenth of 1 per cent. of the total cost of the job, and then overlook the larger items, yet this is frequently the case. This misplaced concentration is not of recent origin, as is evidenced by the following extract from Rawlinson's Herodotus, the original of which was written about 400 B. C. Speaking of the Pyramids of Gizeh, he states:

"There is an inscription in Egyptian characters on the pyramid which records the quantity of radishes, onions, and garlic consumed by the laborers who constructed it; and I perfectly well remember that the interpreter who read the writing to me said that the money expended in this way was 1,600 talents of silver."

In a job which took 100,000 laborers twenty years to erect, the only item of cost considered worthy of handing down to posterity, was not the man hours, cost of transportation or the methods of construction, but the cost of the "radishes, onions, and garlic consumed."

Some systematizers advocate the practice of making the cost records an integral part of the general accounting records, others, especially engineers, argue in favor of a complete divorce of the two sets of records. Webster defines cost as, "The price, value or equivalent of a thing purchased; the amount in value paid, charged, or engaged to be paid, for anything bought or taken in barter. The word is equally applicable to the price in money or commodities."

It is evident, that the total cost of a job includes all the expenditures, both in cash or commodity, made or incurred for that particular job. These cannot all be determined by a system that is entirely independent of the general accounting system, and vice versa. There are many items that cannot be accurately entered in the general records without a proper distribution having been made of them by the cost department. A system in which neither is entirely dependent upon the other, but in which both are interdependent, will give the best results.

It has been the general experience when cost systems are devised and put in operation without regard to the general accounting system, that their results, if good, are merely a matter of chance; frequently they are inadequate; and, generally, the system breaks down altogether. The main cause of failure is the lack of close connection with the general system, for where that system does not segregate those items which constitute the rightful material of the detail cost system, (and grouping all other items under their proper headings), the field is so indefinite that the cost department does not know what to include and what to exclude in making calculations; and there is no mathematical proof that all omitted items are included in the calculation of percentages to be added to direct cost.

Although a cost system should tie in with the general system, the costs should not be handled wholly from an accounting standpoint, but due consideration should be given to the engineering features involved. The only reason that the total of the cost records should check with the amount segregated by the general system, is to make sure that all necessary items are included.

A set of forms do not make a cost system. Forms are merely the vehicle of expression and a means of recording the present activities of the organization and preserving them for future reference. The forms that have proven of value to one contractor may be worthless to another one in the same line. There are no "standard" forms for any one class of work, but they should be designed to meet the conditions of the individual business, as the correct designing of the forms has much to do with the facility of handling the system.

The success of the system is not dependent upon the fact that the labor tickets are pink instead of yellow, or that the material requisitions are 4 in. x 6 in. instead of 5 in. x 8 in., or that the kind of work done is reported by a mnemonic code instead of a written description, although there are minor advantages to be obtained by the systematic use of forms.

Before a form is put into operation, its make-up should be carefully considered, not only in regard to the specific items that the form is to record, but in its relation to every other form in the system. Many systems are "form mad," i.e., the forms are so numerous and they so duplicate both useful and useless data, that the system degenerates into an incoherent mass of confusion.

Installing a System

One of the peculiar characteristics of human nature is to resist any change from regular routine. Consequently, in order to avoid friction, it is best, when commencing the installation of a cost system, to proceed gradually, taking each class of work separately and developing the reports for that particular part of the work, keeping in mind, however, the relation between that part and the work as a whole. As soon as one part has been analyzed and organized, take up the next one, and so on, enlarging the scope of the system, step by step.

Too many systems are installed without taking into account this "human equation." It is assumed that the men using them are reasoning, thoughtful and analytical. Patient work is required among the men in the different departments, in explaining to them the various workings of the system. If they do not understand it clearly, they become suspicious and look upon it as an indication of lack of confidence in their ability. The system should be put forth with the sanction of the highest authority and should not be allowed to interfere with the progress of the work.

No system, however good, will give immediate results. It must be established and must have run smoothly for months and even years, before the full advantages are released. For all progress is made by comparing what is being done to-day with what was done some time ago, and this can be done to any purpose only when the bases of comparison are similar. No spasmodic efforts at the introduction of new methods are of the smallest value.

To secure the nearest possible approach to accuracy in cost keeping, the records should be made at the time the transaction occurs and not weeks or months later. There are and will always be many questions as to the meaning and correctness of records that must be referred to the operating departments, and the time to do this is when the incident is still fresh in the foreman's mind. To be of final and real commercial and technical value, records must be continuous and extend over various fluctuating periods of trade.

Labor

Since correct cost accounting depends upon the correct measurement of direct labor applied, it is obvious that this measurement of time must be accurate and not subject to the desire of any employee to improve his efficiency record at the expense of facts. It is desirable that the keeping of time be done by some one in authority and not by the workman.

Inefficient timekeeping not only results in a sure loss of cash, but always bears with it a lot of consequent losses in the way of useless clerical labor, unreliable cost information, faulty efficiency records, padded payrolls, etc.

There are several different bethods of determining the wages that a workman is entitled to receive. The conditions of the work in question will determine the advantage of one method over another, and before any plan is adopted, those conditions should receive careful consideration.

Some of the most used plans, with their respective advantages and disadvantages will be discussed briefly.

First, there is the "day rate" plan, in which the workman is paid a certain rate per hour or day for being on the job. He stays on the job so many hours for so much money, the amount of or lack of work that he does depending upon the degree of control which the foreman possesses over him. Of course, there are exceptions to this, but they do not remain exceptions for very long, because as soon as they see that the others are getting as much pay as they are for less work, they slow down to the same pace. The advantages claimed for this plan are that it is the simplest and provides the easiest payroll to make up.

The total amount paid to a contractor for a job can be considered as divided into the number of payments for different classes of work—so many units of concrete, so many units of excavating, so many units of brickwork, etc. To be consistent, it would seem that the contractor should pay for the work done in the same manner, i.e., so much accomplished by the "day work" plan, which pays only for the number of hours spent on the job, irrespective of the quantity of work done.

To overcome this condition, the "piece work" plan was devised. Under this plan, the workmen are paid according to the exact amount of work done and their earnings are in direct ratio to their efforts and abilities. The solution of the question of the piece rates to be paid is one requiring great care and expert judgment. If the rates are set too high, the men will dig in and earn from two to three times their regular day work pay, and the contractor, feeling that he has been imposed upon while operating under the day work plan, will cut the rates. This causes dissatisfaction among the workmen, who will then work just fast enough to earn the maximum that they think the contractor will stand for without making another cut If the rates are set too low, there will be no incentive for the workman to exert himself, and as he will not earn as much as under the day work plan, he quits the job, which, when labor is scarce, is a serious matter for the contractor.

Therefore, as stated above, the question of rates should be made the subject of a careful investigation, so that they are equitable to all concerned. More rigid inspection is necessary under this plan, as the increased wages to be earned provide a strong incentive to haste and corresponding carelessness.

Another plan is the "premium plan" in which the increase in wages is based on the time saved on any particular work. The workman is given a fixed task, measured in quantity of work to be performed in a given time, and he receives as a bonus a certain percentage of the time he saves by performing the task in less time than allowed. This plan also pays a minimum wage per day, which assures the workman of a certain wage in case he fails to save time on account of conditions beyond his immediate control.

Any saving in time benefits both the employer and employee. To illustrate: a certain job carries a time allowance of 10 hours, workman to receive 50 per cent. of time saved; assuming that the wages are 30 cents an hour, the following conditions result:

Time Taken	Hours Saved	Hours Workman is Paid for	Labor Cost at $0.30 Per Hour	Workman's Wages Per Hour
10 hrs.	0 hrs.	10 hrs.	$3.00	$0.3000
9 "	1 "	9½ "	2.85	3.3167
8 "	2 "	9 "	2.70	0.3375
7 "	3 "	8½ "	2.55	0.3643
6 "	4 "	8 "	2.40	0.4000
5 "	5 "	7½ "	2.25	0.4500
4 "	6 "	7 "	2.10	0.5250

In addition to the above labor cost, there is a proportionate saving in overhead expenses, due to the increase in work turned out for the same daily expenses.

Under the piece work plan, the workman gets the benefit, the employer saving only on overhead expenses, while under a premium plan, both obtain benefits; the workman in increased wages and the employer in reduced labor costs and overhead expenses.

There are several other premium or bonus plans which are variations or combinations of the above.

When installing any wage system, a careful study should be made of the class of workmen employed, and that plan selected which seems best suited and that will produce agreeable relations between employer and employee.

The question of the apportionment of the cost of the material is a comparatively simple one, and the results obtained will be practically correct. The prices of material are affected by fluctuations of the market, but as most of the material for a structure is furnished under contract, these daily variations in the market price will not affect the costs.

The unit cost of the material should be the cost at the place it is used and should include all freight, express, dryage and other charges incurred for that particular material.

In addition to the money value,, the cost records should show the entire quantity consumed for any one piece of work. By entire, is meant the total quantity necessary to complete the work and not only the amount left in the finished work. For instance, in making forms, there is always a certain amount of waste in cutting, which must be included in the total amount shown by the cost records as necessary to make the forms, if the records are to be of any particular value.

The size of the job and the value of the material will determine the necessity of a storeroom and a set of stock records, although in all cases it would seem advisable to provide proper storage facilities. Most contractors keep an accurate check on their cash, and as material is the same as cash, in that they have been exchanged for each other, it would seem only proper that the material should be subjected to as careful supervision as the cash. When material is not properly taken care of, it is liable to misuse, unnatural depreciation, pilfering, etc., all of which increase the cost above that provided for in the estimate.

Depreciation

That a contractor may do business at a percentage below cost, discount his bills, meet his payroll promptly and maintain a good credit rating for years, without his books showing a dollar of loss, is a condition not generally recognized, but nevertheless true. This may seem a paradox, but the explanation is simple. The average contractor, working without a cost system, does not include depreciation of equipment among his items of expense. There are many other items that are easily omitted when the expenses are not subject to the rigid requirements of a scientific cost system. This accounts for the fact that many contractors who seemingly are working at a profit, suddenly find themselves with nothing but a worn out plant to show for years of effort. The moneys that have been considered as profits and paid out in dividends, should be in a sinking fund for the replacement of the plant when it is worn out.

The subject of depreciation is one that cannot be treated lightly. It is one of the most uncertain factors as far as absolute accuracy is concerned. The rates to use must fit the individual case, each item being given separate consideration. They should be so fixed that when the equipment or plant becomes worn out or obsolete, the jobs upon which it was used during that period have completely absorbed the original cost. An important point in this connection is, that the rates should not be based on the manufacturer's estimate of the life of the machine, but upon the period of usefulness to the contractor.

For instance, a manufacturer may claim that his machine will last 20 years: this would give a rate of 5 per cent. per annum, but in ten years, due to improvements in design, the machine may be so completely obsolete, that it would be folly to attempt to use it in active competition, although it may not be worn out. The depreciation of this item should have been figured at 10 per cent. per annum.

The importance of depreciation should be fully realized upon the installation of a cost system, otherwise the early profits will be overstated and a fictitious value placed upon the plant items in the balance sheet.

Points Respecting Reinforced Concrete*

By Arthur E. Collins, M. Inst. C. E.

THE ease with which the best shapes for any particular construction can be obtained in reinforced concrete has always made it a fascinating material to engineering and architectural designers. Its durability has been proved in many ways, including the life of reinforced-concrete houses built in Newcastle-on-Tyne half a century or more since. When the brick walls of the sea lock at Lowestoft were pulled down some years since the writer saw hoop-iron reinforcing taken out quite free from rust. It had been in position between high and low water for half a century or more; its condition was due to the protecting influence of mortar. All the reinforcing iron found was in equally good state. That reinforced concrete is reliable is shown by the large number of bridges, reservoirs, piers, wharves, sewers, and buildings of all sorts constructed of it and giving good service.

About fifteen years since, the writer constructed reinforced concrete floors in a large building he was then erecting. To obtain lightness he used furnace clinkers largely in his aggregate. His equanimity was much upset by the forward movement of the whole front wall of the building, four storeys high, upon the asphalte damp course, which investigation showed to be due to the presence of sulphur in the clinkers, resulting in expansion of cement in the concrete floors. The movement amounted to less than half an inch and did not continue, nor have the floors given trouble, but furnace clinkers have not been used since.

Care must be exercised all round. For instance, water flowing from woodlands containing vegetable extractives has a prejudical effect on cement. Aggregates, such as destructor clinker, containing free lime, are injurious. In his own work the writer has had concrete walls, pavements, steps, and other constructions injured thereby. Clinker, coke breeze, and other aggregates containing sulphur must always be avoided; they are destructive of cement. Some shale bricks contain sulphur, and old bricks of this variety are unsuitable for concrete aggregate.

The earliest use of reinforced concrete in road foundations known to the writer was by the President when engaged in road improvements in advance of tramway construction for the Middlesex County Council. In one of these roads the writer visited with him, the regrading necessitated a considerable depth of clay fill: to avoid the worst consequences of settlements he covered this with a reinforced-concrete raft. Upon recent inquiry the writer ascertained this had been successful.

Reinforced concrete is a most adaptable and suitable material for constructing manholes, underground chambers, etc., in unstable or water-bearing ground. The structures can be moulded in the dry and sunk to the required depths, necessitating the minimum of timbering and pumping.

For retaining and abutment walls, reinforced concrete is especially suitable, particularly where great width of foundation and weight are wanted, as in many dock walls. The walls can be constructed with flat-plate or deck foundations, of any desired extension, vertical flanges, buttresses or revetments, and weighting shelves moulded at the back of the wall so that the whole construction is monolithic. The soil removed in preparing the foundation can be filled in on the plate or deck foundation, and upon the weighting shelves at the back of the wall to provide the necessary weight.

The writer has used reinforced concrete largely in sewer construction and with great economy. There are considerable lengths of reinforced concrete gravitating sewage and surface water sewers in Norwich from 42 in. diameter down to 21 in. Some have been laid a quarter of a century. All have been entirely satisfactory: no repairs have been done to any of them, and they are as good as when laid.

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* Written for the Annual Conference of the Municipal and County Engineers, July, 1915.

Brick Production in the United States

A report will shortly be issued by the United States Geological Survey which will show that the value of brick and tile produced in the United States, during the year 1914, was less by $13,707,935 than the production of 1913. This is progressing backwards at the rate of nearly ten per cent. in one year.

The value of common-brick produced in 1914 shows a loss, as compared to 1913, of $6,365,233, or more than eleven per cent. in one year. According to the preliminary figures, it was the worst year in the recorded history of the department, the records going back to 1903 inclusive. In addition to the drop in the quantity produced, there was a drop in price—the average falling from $6.20 per M. in 1913 to $6.12 per M. in 1914.

Face-brick production fell off in value to the extent of about $324,515, as against 1913. This is a loss of only three per cent., and shows that face-brick withstood the pressure of competition and hard times better than its less aristocratic brother-in-clay.

Paving-brick is the only important clay product that increased its output in 1914, the gain being $362,345 or a little less than three per cent. better than 1913.

Fire-brick sustained a loss of $4,199,575. The value of the 1914 output was $16,427,547, while that of 1913 was $20,627,122. This is close to twenty per cent. The loss is due, it is said, to the almost complete stagnation of the iron and steel industries during the early months in the year.

The following wash is recommended as effective waterproofing for cisterns, silos and similar structures. A stock solution is made of 1 lb. lye, 5 lbs. alum and 2 quarts of water. A pint of this solution is added to a bucket of of water and 10 lbs. of cement, making a paint-like mixture to be applied with a brush. This is a modification of the Sylvester process and depends on the precipitation within the pores of the concrete of insoluble alum soap or alumina hydrate, or both together.

The hardest kind of steel may be drilled with ordinary drills by using a lubricant of one part of spirits of camphor and four parts of turpentine. Mix thoroughly and apply cold, allowing the solution to remain a short time before applying the drill. Run the drill slowly with fine feed.

The Wychwood (Toronto) Branch Library

REPRODUCED herewith is the design for the Wychwood (Toronto) Branch Library, prepared by Messrs. Eden Smith & Sons, Toronto. The reading room and library are 70 ft. long by 30 ft. wide. This portion of the building, which is raised 7 ft. above the ground level, is really a large hall, with an open timbered roof, the walls being 19 ft. high to the springing of the roof, and the ceiling 29 ft. at its apex. The stairs from the Bathurst Street entrance lead into this hall from under a gallery screen. At the other end of the room is a large stone fireplace. Bookshelves line the walls on each side to a height of about 8 ft. Above the shelving, all around the room, transomed and mullioned windows provide plenty of light. The wall between the windows will be finished in grey stucco.

Below this hall is the basement floor, which is ten feet in height.

An adaptation of the English Seventeenth Century Collegiate architecture was chosen for this building, because the plan of its requirements, the material, brick and stone, which were found most convenient to use, are not at all appropriate for a monumental building of Greek or Roman origin, such as are popular in many cities. The basement is to be faced outside with grey stone to the height of the main floor. The external walls above this will be of tapestry brick, and the detail work, doors and windows, transoms, and mullions, of grey stone, like the basement. The roof is to be covered with grey-green slate. The casements are to be glazed with clear glass in lead bars.

The proposed Wychwood Library.

Consistency of Concrete

IN a paper read before the Connecticut Society of Engineers, results are given of a series of careful tests made to determine the effect of varying the percentage of water in concrete. The principal conclusions of the author are summarized below.

The percentage of water has a direct bearing upon the strength of concrete. Nevertheless, it is the exception rather than the rule that the engineer concerns himself with the question of mixing beyond seeing that the proper proportions of sand, stone and cement are used and the contractor is generally allowed to mix these materials as he thinks fit.

In preparing the specimens for his tests, the author found it necessary, when making mixtures containing more than 27.5 per cent. of water, to increase the proportions 10 per cent. in order to fill the moulds. This indicates an increase in density which was obtained at a loss of strength. However, in some cases this is highly desirable. Often bulk and impermeability are the two requisite features. In reinforced concrete structures a moderately wet mixture is far more practical than a dry one; but it must not be forgotten that the use of wet mixtures increases the cost of materials. An increase in density means a corresponding increase in raw materials. The additional water weakens the concrete, and therefore a richer mixture or lower unit stresses must be used. The former is preferable, for the beams and columns in concrete building are always heavier than the corresponding members of steel or wooden structures.

If a wet mixture is used, the engineer should be cautious in permitting the removal of the forms at an early date. In some of the tests the wet mixtures were very slow to develop their strength. The use of such consistencies in practice would necessitate extreme care. It might be a month or more before the forms could be struck with any felling of security.

The question of consistency is not altogether a laboratory question. The increased cost of materials due to the use of wet mixtures may be more than balanced by the saving in placing; but the engineer should bear in mind that consistency has a direct relation to strength, and if he permits a wet mixture he should provide the same in his design. In any event he should control the details of the mixing.

The Coming Industrial Boom

A well-known firm of patent agents, writing to the Illustrated Carpenter and Builder, say that everything points to the probability of the advent of an industrial boom, which will eclipse all previous activities of a like character hitherto experienced in Great Britain, and in which inventions will play an unprecedented part. That this is not mere surmise is evidenced by the greatly increased number of applications for patents made by German inventors since the outbreak of hostilities, the number of such applications having steadily increased until at the present moment, it is significant to note, they are in excess of the number made by American inventors.

This unusual activity on the part of German inventors clearly shows that they foresee the great industrial boom after the war, and intend to be well prepared for it. It is for British inventors, therefore, to counteract this move on the part of the Germans, and to proceed immediately with the task of improving all classes of automatic labor-saving machinery and inventions relating to building equipment.

The inventors who have their inventions perfected, and ready to place before manufacturers at the end of the war, will reap the benefit, as British manufacturers, after Government orders cease, will be on the look-out for specialties, firstly to keep their increased plants going, and secondly to capture the markets which the Germans held prior to the war.

To make a permanent cement used for stopping leaks in steam pipes where caulking or plugging is impossible, mix black oxide of manganese and raw linseed oil, using enough oil with the manganese to bring it to a thick paste; apply to the pipe or joint at leak. It is best to remove pressure from the pipe and keep it sufficiently warm to absorb the oil from the manganese. In twenty-four hours the cement will be as hard as the iron pipe.

Problems in the Design of Reinforced Concrete Buildings

POINTS of special interest to designing engineers are contained in a discussion (in Concrete-Cement Age) of the queries propounded below. The subjects are taken up in order by Mr. A. C. Janni, who is Consulting Engineer for the New York Central, and by Mr. A. M. Wolf, Principal Assistant Engineer, Condrom Company, structural engineers, Chicago.

> 1. "Is it right to consider beams entering wall columns as continuous or partially continuous?
>
> 2. "Should the effect of eccentric loading on columns be considered?
>
> 3. "If a beam enters a wall column and is considered to be continuous or partially continuous, what effect does it have upon the eccentric loading of the columns?
>
> 4. "If a column is avowedly eccentrically loaded and no provision for this is made in the design should we consider entering beams as freely supported or consider them as continuous or partially continuous because of the monolithic nature of the construction?"

By Mr. Janni

(1) In general, a beam entering a wall column, or any other quasi-rigid long support, may be considered as continuous, or partially continuous, according to the conditions of the supported end of the beam.

If the supported end of the beam has such a length that the allowable adherence between the concrete and the reinforcement in this supported end is at least equal to the tensile stress in the steel arising out of the assumption of continuity, it is clear then that the assumption of a continuous beam for the end of a beam entering a wall column is legitimate.

It should be borne in mind, however, that no matter what the assumption is with respect to that supported, a certain part of the adherence between concrete and steel, in the supported end of the beam, must withstand the shear in the beam. This fact, at first, seems in contradiction with theory and a few words of explanation are perhaps necessary.

Let us suppose that in Fig. 1 AB is a beam supported at both ends and uniformly loaded; the shear diagram will be given by the line CD.

As in any section of the span the adherence between the longitudinal steel reinforcement and the concrete is proportional to the vertical shear in that section of the beam, it is plain that on the right of B, as well as on the left of A, the reinforcement should not have any tendency to slip, as there is no vertical shear in any cross-section of the supported ends of the beam.

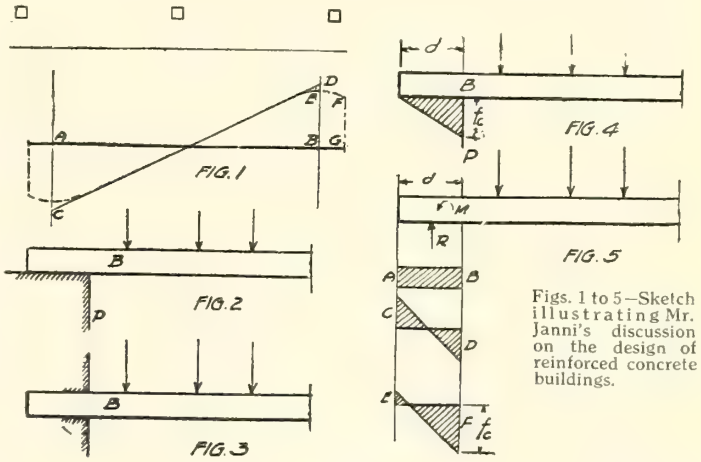
Tests, however, show that, while for limited efforts the theoretical formula holds good, this is not the case with higher stresses, even far below the breaking point of the beam.

The above phenomenon, apparently in contradiction of theory, finds its explanation in the fact that the modulus of elasticity of the concrete is not constant, but diminishes with the increasing stresses; so that, starting from a certain value of stress, the concrete begins to loose gradually its grip on the steel, which then finds a new position of equilibrium, extending its tensile action behind the vertical lines of supports.

The dotted line in the figure below should represent the diagram of shear. Incidentally it may be seen that the maximum actual shear is smaller than the theoretical one.

As said before, a designer, in assuming the hypothesis of the continuity of a beam entering a wall column, should take care first of the amount of shear shown by the diagram BEFG, and afterwards satisfy himself whether or not the remaining part of the allowable adherence is enough to withstand the moment due to the fixed end assumption.

Mechanical devices such as deformed bars, hooked ends properly made, etc., are, in a general way, good means of insuring the fixedness of that part of the reinforcement of the beam on the supports, while the vertical reinforcement of the column passing through the supported end of the beam insures its quasi-rigid connection.



Figs. 1 to 5—Sketch illustrating Mr. Janni's discussion on the design of reinforced concrete buildings.

Similar remarks may be made regarding the assumption of a partially continuous beam.

(2) The effect of eccentric loading on columns is an important condition of equilibrium, which should be investigated by the designer.

A column with eccentric loading is under the action of axial compression and bending; and specially for long spans carrying heavy live loads the compressive maximum stress may reach important values, the tensile stress in the steel doing likewise.

(3) A wall column being a column rigidly connected with the wall, no matter what the assumption of the beam entering the wall column may be, it has no appreciable effect upon the column itself.

In connection, however, with the idea of a beam and its supports, there is a certain point in the design of a beam entering a column, or a wall column, which is often overlooked by some designers; the point referred to is the investigation of stresses upon the support of a beam, arising out of the various assumptions made concerning the supported end of it, or in other words out of the reaction of the support.

A few words on this subject may not be amiss.

Let Fig. 2 represent the case of a beam with a supported free end, and Fig. 3 the case of a beam with a supported fixed end.

The distribution of the compression upon the support P, in Fig. 2, which is indeterminate, should be assumed, for the sake of safety, to vary according to a straight line, as shown in Fig. 4, the maximum compression fc being given by:

$$fc = 2 \frac{R}{b \times d}$$

where: R = total reaction,
b = width of beam,
d = length of the supported end of beam.

The case shown in Fig. 3 is never fully realized in practice; but the investigation of the stresses upon the support P should always be made.

This case may be represented as in Fig. 5, the reaction R being a compression and M the moment.

The diagrams to which each of these reactions give place are shown in Fig. 5; AB being the diagram due to the vertical reaction R (compression) and CD being the diagram due to the moment M.

Adding those two diagrams together, the total diagram EF is obtained, which gives the maximum fc, the value of which can be given also by the expression:

$$fc = \frac{1}{b \times d} R + 6 \frac{M}{d}$$

where the letters have the same meaning as above.

(4) A column, which, being eccentrically loaded, has been designed disregarding such condition of loading, is a deflective unit of construction, the conditions of equilibrium of which can hardly be improved by assumptions regarding the beam supported by it.

The assumption of a freely supported beam, while it is rightly made for the sake of safety, with respect to the beam itself, cannot be upheld with respect to its support, especially when this support is a column whose reinforcement extends vertically through the end of the beam and above it.

The prevented movement of the supported end of the beam during its deflection gives place to a moment, no matter whether or not the designer in his assumption took care of it.

Even if the reinforcement of the column does not extend in the beam end and above it (which would be another serious mistake) the friction between the top of the column and the bottom of the supported end of the beam is such that it would tend to deflect the column toward the span, during the deflection of the beam.

In either case, therefore, a bending moment is developed at the top of the column, which should have been taken care of.

The other two assumptions, namely, continuous and partially continuous beams, which are more proper for a beam entering a column, while they would result in economy, would not improve the conditions of the equilibrium of the column.

By Mr. Wolf

In the writer's opinion it is right and proper to consider beams entering wall columns as continuous or partially so, the degree of continuity depending mainly upon the number of spans in the building parallel to the beam in question, the reinforcement of beam and the size and location of column, that is, whether the latter is in an upper or a lower storey.

The degree of continuity to assume in beams cast monolithic with columns is dependent upon so many conditions that exact rules are impossible of formulation.

For example, a beam may be built monolithic with a wall column, but so little steel provided for negative moment at the column that when loaded the beam cracks at the top and the continuity is entirely destroyed and the beam becomes practically a simple span. It is apparent, then, that to have continuous action, steel must be provided in the top of the beam to care for the stresses developed. Just how to arrive at the amount of reinforcement necessary is a subject regarding which much has been written and as a result we have some bending moment formulas covering average conditions and which give safe results, and have been used to a considerable extent, and in addition are recommended by the Joint Committee. These are $Mwl^2/12$ at centre and at support for interior spans truly continuous and for end spans $Mwl^2/10$ at centre and adjoining support of end spans for both dead and live load under favorable conditions of fixity. For beams and slabs continuous moment is usually taken as $wl^2/8$ at central support and $wl^2/10$ near middle of span. (These moments, of course, being for uniformly distributed loads).

A beam is said to be fixed at both ends when the tangent to the elastic curve is horizontal over each support. Now a beam framing into a large lower storey exterior column which is relatively very stiff and unyielding will, if properly reinforced, be very nearly fixed, and it is evident that if steel is provided for a moment of $1/10\ wl^2$ over the supports and the centre the construction will be safe, for a coefficient of 1/12 applies to a fixed beam; and 1/8 to a simple beam, 1/10 being an average of the two coefficients.

Taking the opposite case of a slender top storey exterior column supporting a roof beam, it is evident that the conditions are by no means so favorable for continuous action, for more or less bending is sure to take place in the column and the conditions of support approach those of a simple beam. For this reason, then, little or no continuous action should be depended upon in exterior beams of roof construction where light columns are used; here again the judgment of the designer must be used in determining just what moment coefficient to use.

Some designers argue against reinforcing a continuous beam over the support for the full negative moment in accordance with the formulas given above, which are for beams with a constant moment of inertia, for the reason that the negative moment can be reduced by making the beam stiffer in the middle, or in other words, designing for an increased bending moment at the centre and a reduced moment over the supports. It has been generally accepted, however, from studies by Sanford E. Thompson and others that it is in general uneconomical to design a reinforced concrete beam stiffer in the middle than over the support. Sometimes, in order to comply with city building ordinances, it is necessary, in order to economize as much as possible, to design beams which tend to act as continuous for a lesser moment over the support than at the centre, as called for by ordinance; thus making allowance for the increased stiffness of the beam at the centre. Thus, for instance, if by ordinance a moment of $wl^2/8$ is specified at mid-span for continuous beams the steel over the support should be 6/10 of that at centre to have the beam act as somewhat continuous, and, at the same time, be as economical as possible in the use of steel. This practice is often followed, but truly continuous action is not obtained, even if the safety of the structure is not endangered. For truly continuous action to develop, it is necessary that the member be designed for the maximum theoretical moment which occurs over the support for uniform loading, and for a number of continuous spans uniformly loaded, this is $-/12\ wl^2$. Now if less steel than is required by the above formula is placed over the support, the steel will be overstressed and cracks will tend to develop.

Some building ordinances sanction this practice by stating that the sum of the centre moment and that over support should be $1/6\ wl^2$ and that at least sufficient steel to fulfill the requirements of a moment equal to $1/18\ wl^2$ shall be used over the support. Such recommendations have led inexperienced and commercial designers to become "expert jugglers" of moments, making them whatever seem best to suit their needs. In fact, more faulty designs can be traced to this practice than to any other one cause.

It does not require much demonstration to prove that continuous action cannot be obtained by using a centre moment of $1/9\ wl^2$ and a moment of $1/18\ wl^2$ over the support (as the total moment of $1/6\ wl^2$ requires). In such a case the steel over the supports will be greatly overstressed and cracks will occur over the supports and the beam approach the condition of a simple beam, provided, of course, that the ends are supported. Finally, it can be said that it is impossible to obtain any desired distribution at centre and supports by the simple variation of reinforcement. The laws of mechanics govern these things, not the whims and desires of the designer.

The effect of eccentric loading on columns should be considered, but to arrive at a mathematically correct solution of the problem is practically impossible on account of the number of variables which must necessarily be considered. Ordinarily in buildings where the extent of the live load is very indefinite it will generally be found satisfactory to reduce the unit stress in exterior columns to, say, ¾ or 2/3 of the average unit stress used for interior columns, depending upon the type of construction, for to compute the stresses due to eccentricity for the great variety of conditions of loading which might occur is not justifiable. In structures in which a definite condition of live load is to be maintained at all times the effect of eccentricity should be carefully looked into. The best treatment of the subject of eccentric loading considerations on columns, in the writer's opinion, is found in Reinforced Concrete Design, by Faber & Bowie.

When a beam centres a wall column and is considered to be continuous or partially so, the result is that additional bending is thrown into the column, or, in other words, the eccentricity is increased, and provision should be made therefor in the design of the column.

In regard to the last question, this has practically been answered in the foregoing. If a beam is considered as freely supported and designed as such (there is no reinforcement placed in top of supports), the eccentricity on columns will not be so great as if the beam is designed as continuous or partially so. Therefore if no provision is to be made in column to care for the bending due to eccentricity, beams should not be designed as continuous or partially continuous at the support. This, however, is not good or economical design, for it would probably, in most cases, require no more steel to design beams as continuous and to strengthen the columns to care for the eccentric load imposed, than to design the beams as simply supported and not strengthen the columns. Reinforced concrete from its very nature tends to act as monolithic or continuous and therefore, wherever possible, advantage should be taken of this characteristic, for this is the distinguishing mark of the most advanced reinforced concrete design.

The C.P.R. Rogers Pass Tunnel

Progress on the Rogers Pass tunnel of the Canadian Pacific Railway has been very satisfactory. It will be remembered that this 5-mile double-track is being driven from intermediate headings reached by crosscuts from a pioneer tunnel or heading parallel to but outside the line of the main tunnel. The pioneer heading has been completed and there remain to be driven 2.05 miles of main heading and 3.31 miles of enlargement to the double-track section. The concrete lining of the earth section is nearly completed, and it is expected that the concreting of that portion of the rock section which requires lining will be finished during this year. The tunnel will probably be completed and ready for operation in September, 1916. The progress made during 1915 is given, from a statement furnished by Foley Bros., Welch & Stewart, the contractors. A C. Dennis is superintendent for the contractors.

	East End			West End		
1915	Pioneer Heading, Ft.	Main Heading, Ft.	Enlargement for Double Track	Pioneer Heading, Ft.	Main Heading, Ft.	Enlargement for Double Track
January	592	443	443	932	699	210‡
February	620	440	422	650	634	247
March	595	196*	379	617	752	413
April	751	442	553	569	741	588
May	658	417	718	730	618	685
June	776	471	659	808	393	729
July	682	538	726	731	969†	812

*Half-month. †Two headings. ‡Timbered.

The contract for the first water storage project of the Streams Commission of the Province of Quebec was awarded recently. This development provides for a storage reservoir of a capacity of 160,000,000,000 cu. ft. The primary object is the regulation of the flow of the St. Maurice River. The contract was awarded to the St. Maurice Construction Company, Limited, at about $1,425,000, but it is reported that the actual construction will be done by Fraser, Brace & Company, Limited, Montreal, Que. The storage dam will be of the gravity type constructed of mass cyclopean masonry. It will have a total length of about 1,720 feet, a maximum height of 80 feet, and a width of 20 feet at the crest. The spillway portion will have a total length of 865 feet. The bulkhead section of the dam will be about 435 feet in length with a base width of 60 feet.

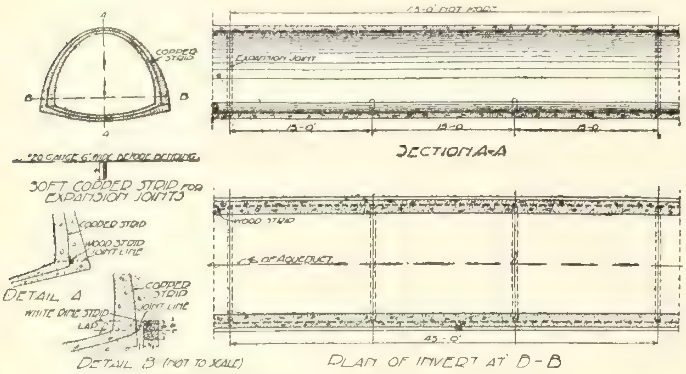
One of the recent developments in the way of builders' hardware is a screwless hinge which has two steel projections on each end. On the end next to the door stop there is a straight steel projection that enters the wood and on the other end of the hinge there is a clamp projection that enters the door casing. These projections or hooks counteract and offer the same resisting and holding force that the screw offers to the hinges. Besides doing away with the use of nails and screws, the statement is made that it gives the hinge a much neater appearance than those of ordinary construction.

Expansion Joint for Reinforced Concrete Aqueduct

THE accompanying illustration shows a form of expansion joint adopted by Mr. W. G. Chace, Chief Engineer of the Greater Winnipeg Water District, for a reinforced concrete aqueduct 84¾ miles long, with a capacity of 85 million gallons a day.

In the construction of this work, the invert is laid first in 15 ft. lengths, and between the ends expansion strips of 20-gauge copper, 6 in. wide, are placed, extending across the full width of the joint. East strip is bent along the centre to form a ½-in. offset, occurring exactly on the joint between the concrete surfaces. After the invert has set, the arch is moulded upon it in 45-ft. lengths, the joint joints being over every joint in the invert. In the 8-ft. diameter circular section of the aqueduct the expansion joints are spaced 30 ft. apart.

The fundamental idea of the joint is that the effect of contraction in the concrete will merely be to open the copper offset without tending to break the bond between the anchorage surfaces of the concrete and the copper. With the object of preventing any percolation through the horizontal joints between the invert and the arch above, strips of 1⅛ in. by ¾ in. white pine are built into the concrete throughout the length of the aqueduct, as shown at B, and care is taken to protect the joint until the concrete has thoroughly hardened.



Details of expansion joint.

Transverse Joints in Brick Pavements

IT has been customary in the past to provide both longitudinal and transverse bituminous expansion cushions in grout-filled brick pavements, but recent practice has demonstrated that the transverse cushions may be advantageously omitted if proper longitudinal cushions are provided. This is the opinion expressed by Vernon M. Pierce and C. H. Moorefield, of the U. S. Office of Public Roads. The principal objection to the use of transverse expansion cushions is based on the fact that the material composing the cushions frequently softens during warm weather and runs out toward the curb, thus leaving the edges of the adjoining brick exposed to destructive impact from the wheels of passing vehicles. Even if the cushion consists of a material which does not run in warm weather, it is necessarily softer than the brick, and the natural result is still the development of unevenness in its immediate vicinity. No such objection can exist concerning longitudinal expansion cushions, however, if they are placed adjacent to the curbs and constructed of proper material. They not only furnish a means for the pavement to expand and contract with changes in temperature, but they also eliminate to a large extent the disagreeable rumbling which has been so frequently associated with grout-filled brick pavements. The bituminous material of which the expansion cushions are made should be such as to remain firm in summer and not to become brittle in winter. It should also posses the quality of durability.

Expansion cushions should be provided for at the time the brick are laid by placing a board of the required thickness on edge adjacent to each curb. Small iron wedges may be inserted between the curb and the board at the time the board is set. These wedges may be readily loosened and removed after the bricks have been laid and grouted, and may consequently be made to facilitate the removal of the board.

The proper thickness for expansion cushions is a matter concerning which much difference of opinion exists among highway engineers. Some engineers advocate a minimum thickness of 1 inch, while others claim to have secured their best results by using expansion cushions having a minimum thickness as low as ⅜ in. for very narrow pavements. It is generally agreed that the thickness of the cushion should vary with the width of the pavement. The following suggestions for proportioning the cushion are offered as being fairly representative of the best practice:

For a 20-ft. roadway the cushion thickness should be ½ in., for 20 to 30-ft. widths, ¾ in.; for 30 to 40-ft. widths, 1 in., and for widths over 40 ft., 1¼ in.

Field Testing of Concrete

IN the past engineers and contractors have not been sufficiently concerned with the actual strength of the concrete entering into structures, says a writer in Engineering and Contracting, commenting editorially, they have been content to accept the results of laboratory tests of the cement and of a few samples of concrete, and have not given sufficient attention to the quality of the aggregates being furnished from time to time or to the methods used in mixing and placing the concrete. That the importance of these factors is being more generally realized is evidenced by the field tests which are being required on several important construction jobs now under way. That such tests are feasible and worth while can hardly be questioned, especially on jobs extending over a considerable period. The Massachusetts Institute of Technology buildings and the Welland ship canal are two important contracts on which field tests of concrete are required. In view of the fact that the engineers in charge of these projects have been compelled to originate their own methods of collecting samples of concrete and of testing these samples the following statements are pertinent:

On the Massachusetts Institute of Technology job two field samples are taken regularly on each section of the work at least four times a week for tests at 14 and 28 days, both samples being taken from the same batch. Wherever possible the samples are taken directly from place; but for beams, columns and girders, where this is impracticable, they are obtained from the barrow before placing. The concrete is shovelled into two 14-quart galvanized iron pails, remixed to eliminate any segregation of materials due to carrying from the work, and poured into iron molds embedded in moist sand. The maximum and minimum temperatures are recorded every day. For mass concrete, where the size of aggregate runs up to 2 or

2¼ ins., the samples are cast in 8 x 16-in. cylinders; but for the superstructure concrete, where the largest size of aggrgeate is not over 1½ ins., 6 x 6 x 12-in. prisms are cast. The bottom of each mold is formed of a ½-in. iron plate, and the concrete is tamped in the mold with a 6-in. ice chopper. Each sample is given one tamp on each face and four tamps at 90 deg. in the centre. The time given to dumping into the molds and tamping does not exceed five minutes. Just previous to the initial set the top surfaces are carefully trowelled with a plasterer's trowel to obtain a uniform bearing in the compression machine. After 48 hours the blocks are removed from the sand, taken from the molds, and reburied in moist sand until the day before they are tested. The following results of some tests made on this work are of interest: The average compressive strength of the 1:2:4 concrete at 14 days was 1,640 lbs. per square inch, while that of the 1:1½:3 concrete at the same age was 2,008 lbs. per square inch. At 28 days the average compressive strength of the 1:2:4 concrete was 2,110 lbs. per square inch and that of the 1:1½:3 concrete at the same age 2,520 lbs. per square inch—each value being the average of about 90 specimens. It is thus seen that the average increase in strength from 14 to 28 days for the 1:2:4 concrete was 23 per cent., while for the 1:1½:3 concrete this increase was 25 per cent.

The value of this system of sampling and testing was shown at the beginning of the job. Some of the test specimens of the 1:2:4 concrete gave low values, and the method of handling the concrete was changed at once, with the result that subsequent specimens gave proper strengths. The importance of making periodic tests of the aggregates was realized by the engineers in charge of this work, and an inspector was sent to the sand bank at regular intervals to obtain samples, which were sent to the laboratory for testing.

In building the concrete structures of the Welland ship canal it is required that field samples of concrete be taken during the progress of the work. These samples are made into beams 4¾ ins. wide, 3½ ins. deep, and 3 ft. long, for testing at specified ages. This work is being done at the field office of each section, the tests being made on a special machine designed for the purpose. This machine, which can be constructed at a low cost, has given satisfactory results.

On contracts which extend over a considerable period, field testing is a logical procedure, and we believe it will soon come into general use. The necessity of determining the quality of the concrete which is going into a structure has long been felt, and field testing will do much to insure a more thorough testing of the aggregates as well as better mixing and placing methods. The formulation of a satisfactory set of instructions is essential to the general adoption of field testing, and it is gratifying to note that a sub-committee of the American Society for Testing Materials has been assigned this work.

Reinforced Concrete Pavements and Roadways*

By B. S Pease

THE subject of Reinforced Concrete Pavements and Roadways should receive special attention from consulting engineers, contractors, city officials and taxpayers for two main reasons. **First**, very little if any information up to the present time has been printed regarding this type of pavement either by the press, the engineering periodicals, or by local or national societies, and therefore full realization is given to the prospect of and the necessity for careful study and criticism of the opinions here expressed; **second,** the actual necessity for the use of reinforcement in concrete pavements in order to secure the proper results under varying conditions.

The subject of plain concrete pavements has been very carefully studied and the results of actual construction have received due consideration. It has been definitely shown that a pavement with a concrete wearing surface is low in first cost, gives but slight resistance to traffic, affords a good foothold even on grades up to 8 per cent., and its sanitary qualities and favorableness to traffic are of the highest quality. As to its maintenance cost, the limited experience shows that it is lower than any other type of pavement surface. As stated previously, a great deal of thought and discussion has been given to this form of a wearing surface for street and roadway pavements with the result that a decision has been reached as to the proper mixture, manner of mixing, quality of materials and methods of handling the same. There has been, however, a universal knowledge that there is one great objection to this material and that is, the natural tendency for the formation of cracks.

Assuming the proper mixture, construction, etc., there are three main causes for crack formation, namely, poor foundation, contraction during the setting period, and expansion due to temperature changes. The proper methods for improving the foundation are now standardized, but many times there are local conditions that make it impossible to follow such standards. In other words, the soil itself, either for natural or artificial reasons, may be of such poor quality that it is impossible to secure the proper results by any of these methods. The question then is, assuming their poor foundation, how to properly construct the pavement so that good results may be obtained.

It has been definitely shown that concrete will contract during the setting period, the amount depending upon the presence of moisture, the proportion of the mixture, and the temperature. It is the custom in specifications to state that the foundation shall be sprinkled prior to the depositing of the concrete so that the water in the mixture will not be absorbed by the soil. This is undoubtedly a very good precaution, but at the same time it does not absolutely prevent a loss of the water in the concrete. If this loss should be sufficient to reduce the amount of water below what is necessary to produce hardening by uniting with the cement, the finished construction is undoubtedly weakened; but in any event the less the amount of water, the greater is the amount of contraction. The results of tests show an average decrease in volume during the setting period approximately equivalent to a change due to a variation of 100 deg. of temperature. It is not necessary to argue the point regarding the change in volume due to temperature changes, it being only necessary to mention that such changes do occur.

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* From a paper before The American Concrete Institute.

Assuming that cracks do form in the concrete surface, what are the effects? Cracks formed by contraction will fill with dirt, grit, or other non-compressible material and prevent expansion at a later time when such expansion is necessitated by an increase in temperature. Therefore the beneficial effect of preconstructed expansion joints will be minimized; in fact this effect may be sufficient to entirely destroy the possibility of expansion.

The study that has been given to the proper construction of expansion joints shows that such joints must be protected to prevent the wearing away of there sharp and brittle edges by the action of wheel loads and horses' hoofs. If it is proper to say that the artificial joints will early show wear, is it not as proper to say that the same results will fillow for those joints that have been naturally formed due to natural causes? The final effect of these cracks in addition to being disagreeable to ride over and to their unsightliness, will be to very materially decrease the life of the pavement.

The next question to consider is how to prevent the formation of cracks in concrete pavements. Some have tried the plan of building the pavement in small units with expansion or contraction joints, but experience has shown that this method is expensive, unsightly and not durable. It has been conceded by those familiar with this construction that the joint even when properly protected by means of steel plates is the weak portion of the wearing surface and that it is here where the surface will first break down and show deterioration. Another means of prevention or rather a means of taking care of cracks that have formed is to fill them with an asphalt preparation, the object being to prevent sand or other hard substances from entering the joint and, in addition, to give at least a partial support to the sharp brittle edges. This method requires a certain amount of expense, the protection to the edge of the joint is questionable and the result is unsightly, at least for city pavements.

The Use of Reinforcement

The more recent method for the prevention of cracks is to use reinforcement of a sufficient amount and properly placed, depending upon the conditions. So far as can be determined reinforcement was first used in a concrete street pavement in 1910, and the results obtained since then certainly warrant consideration by those interested, which is the case as shown by the rapid increase in the number of municipalities that have constructed pavements of this type. An examination of available records will show that in 1910 two municipalities in one state used reinforcement in their concrete pavement, while in 1913 at least 56 municipalities in 15 different states contained construction of this type. One and two-course construction has been used in about equal proportions.

In regard to the necessity for and the effect of the use of reinforcement, consider those pavements that will be laid on a foundation of questionable quality. The necessity for the use of a reinforcement to give structural strength to the slab is evident regardless of whether such foundation is poor in spots or whether the entire area shows unsatisfactory conditions. If the foundation consists of filled material, it is almost impossible even by the use of a heavy road roller to secure a foundation that will not settle at some future date. As it is impossible to determine how much and where such settlement will take place, the logical suggestion is to use reinforcement so that the pavement will act as a unit and in this way prevent the formation of the destructive cracks.

If it is impossible to properly drain the foundation, thus allowing accumulation of moisture, the results will be disastrous if no reinforcement is used. During a rainy period water will accumulate near the outer edges, the pavement will settle under traffic loads because of this softened condition and cracks will form first in the top surface. During freezing weather the soil will expand because of the presence of water, thus raising the outer edge and causing cracks to form at the lower side of the slab, and to prevent these cracks reinforcement should be placed as near to the bottom as possible and yet secure sufficient protection to preventrusting.

This latter condition, however, is one that can and should be guarded against by proper drainage, and it is not the intention to advocate the use of reinforcement to take the place of proper drainage when such construction is possible. Therefore the only logical reason for placing the reinforcement at the bottom of the slab is to add structural strength to the slab placed over filled ground that cannot be properly compacted by methods that are or should be familiar to all engineers.

In the construction of country roads the width will usually be such that a part of the metal will extend outside of the old beaten track and therefore the foundation will be more compact under the center portion, even if the center be scarified and re-rolled it will be almost impossible to secure a uniform result. This condition in itself will allow a settlement at the outer edges and cracks will form longitudinally unless suitable reinforcement is used near the top of the pavement.

Owing to the absence of sufficient strength in the concrete during the setting period, it is impossible to conceive how a movement of the pavement over the foundation because of the contraction of the setting cement is to be accomplished. This being the case the assumption naturally is that the concrete contains thousands of invisible cracks which will decrease its strength unless a reinforcement is included to prevent such cracks from opening up to any extent. When a pavement contracts because of a reduction in temperature, cracks will form at more or less regular intervals, the distance between such cracks depending upon the tensile strength of the concrete. It is for this reason, that many engineers advocate a certain definite and close spacing of expansion joints. At the same time they concede that these joints are the weak spots in the pavement; therefore if some other method of construction could be used so that the number of these joints can be reduced, such a method should receive consideration. As concrete in itself has no dependable tensile strength, it is necessary to include a reinforcement to supply this deficiency. For several reasons the practice has been to place this reinforcement near the top of the slab.

For a two-course pavement the logical position is between the base and wearing courses where it will not only resist expansion and contraction of the entire slab but will also act as a connecting link between two bodies of concrete having a different mixture of the ingredients, and in addition it will prevent the formation of cracks along the crown of the pavement where experience shows cracks almost invariably form in pavements that are not reinforced.

For single-course work the reinforcement is usually placed about two inches below the surface. Although this type is called single-course, it of necessity must be placed in two courses or layers in order to include the reinforcement.

Amount of Reinforcement to Use

The amount of reinforcement to use may vary with conditions, some of which must be determined by the engineer at the time, but a careful study of existing reinforced concrete pavements with special reference to the amount of reinforcement used shows that it is possible to specify the amount required in the average construction without knowing all the conditions. For country roads if the expansion joints are placed not to exceed 30 ft. centres, a reinforcement having a sectional area of metal of at least .049 sq. in. per ft. of width crosswise, and .038 sq. in. lengthwise of the pavement, will furnish sufficient resistance to prevent cracks due to shrinkage during setting, expansion or contraction from temperature changes, or to any ordinary inequality of the foundation soil.

The subject of proper spacing of expansion joints should be studied in connection with the reinforcement for the reason that the greater the spacing of joints the greater should be the amount of longitudinal reinforcing metal.

Past experience points to the fact that the principal change in the length of a concrete pavement is a contraction and although the metal has approximately the same coefficient of expansion as concrete and therefore will change in length about the same amount as the concrete, it will prevent the total shortening effect from being localized at definite intervals and will distribute the total change into innumerable small and invisible cracks that will not decrease the wearing qualities of the finished pavement. If the expansion joints are spaced at a greater distance than 30 ft. the amount of longitudinal reinforcement should be increased to at least 0.1 sq. in. per ft. width for spacing up to 100 ft. It is believed that by the addition of a sufficient amount of longitudinal reinforcement, it would be possible to construct the roadway without any expansion jointswhatever.

For street pavements the early practice was to use a very light reinforcement, but the more recent ones have made use of a heavier material even for close spacing of expansion joints. In fact the tendency now is to increase the weight of reinforcement, and since this item is small in comparison to the total cost of the finished work, it would appear to be poor economy to use a light material when for a slight additional expense a proper construction can be assured. The average cost for the reinforcement in place ready for concreting varies from $.07 to $.15 per sq. yd., depending upon the weight of reinforcement used. The same recommendations and the reasons therefor that have been given for necessary reinforcement for country roads will also apply to city pavement with the exception that regardless of the weight of reinforcement used, expansion joints will be required at all street and alley intersections or wherever connected with any permanent rigid construction.

In order that the reinforcement shall give the best results, the various members of which it is composed should be closely spaced so as to give a proper distribution of the metal. The metal should also have a high tensile strength and should be low in cost of installation.

Gravel is about the only hard-surfacing material Iowa has, and an experienced two-course water-bound road 1¼ miles long of that material will be built this year in Webster County just east of Fort Dodge. The road is for the purpose of testing out the gravel along modern lines to meet hard-surfacing conditions. It is to be a joint affair participated in by the city, county, State Highway Commission and the good roads section of the Engineering Experiment Station at Iowa State College. The road will be 16 ft. wide, 8 ins. thick in the centre and 16 ins. at the sides. Frequent tests will insure the proper proportions of gravel and clay binder. A coat of oil will probably be applied one or two months after construction has been completed.

The Inspection of a Building Job

"One of the great problems which the contractor has to face," says Leonard C. Wason, in a paper read before the Boston Society of Civil Engineers, "is that of the inspector who represents the engineer on the work. A thoroughly competent inspector is a great help to the contractor and very beneficial in the results obtained; an incompetent one is exactly the reverse." Mr. Wason points out some of the important qualifications which the ideal inspector must have—an even temper not easily ruffled, a considerate yet firm attitude, always diplomatic and capable of performing his duties acceptably to his employer.

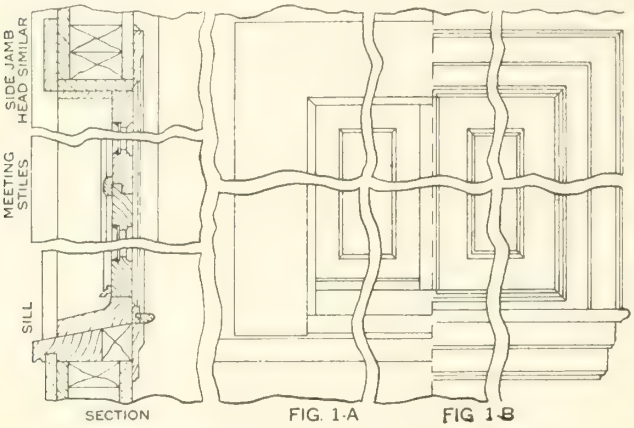
"The superintendent for the contractor is necessarily better informed and better trained in construction—an executive who is constantly directing others and is quick to resist, for the good of the service, insubordination or usurpation of the duties for which he is held to strict account by his employer. Trained to be an autocrat, his temperament does not take kindly to being bossed by another man admittedly with less experience."

It is evident that the inspector must not consider it a personal affront when his orders are overruled. He will make some mistakes which the engineer will correct—many more which his chief will never hear about, although they make unnecessary expense and may affect his chief's professional reputation. He is put in a trying position, the most frequent cause of friction in other men. His most common mistake is in giving the workmen orders direct. It is only by following his own duties and those alone that satisfactory results are obtained and the expense of the job kept within limits.

Over 51,000,000 gal. of water were used during 1914 in Milwaukee, Wis., in an effort to clear the water mains of an accumulation of sand carried into the system during forty years of operation. A special crew, under the supervision of the superintendent of water mains division, was engaged for several months, and the mains were flushed at 577 different points, the total amount of water used being nearly 35,000,000 gal. In addition to the work done by this special flushing crew, considerably more flushing than usual was done by the hydrant inspectors and mains-repair crew, which brought the total amount of water used to nearly 52,000,000 gal. While considerable deposits were removed in this way, a large number of meters were "sanded," and a considerable number of complaints of dirty water were received, owing to the fact that the flushing was done during the day and the house services used while the water was in a state of agitation. Accordingly it has been recommended that the flushing hereafter be done at night while the house services are inactive.

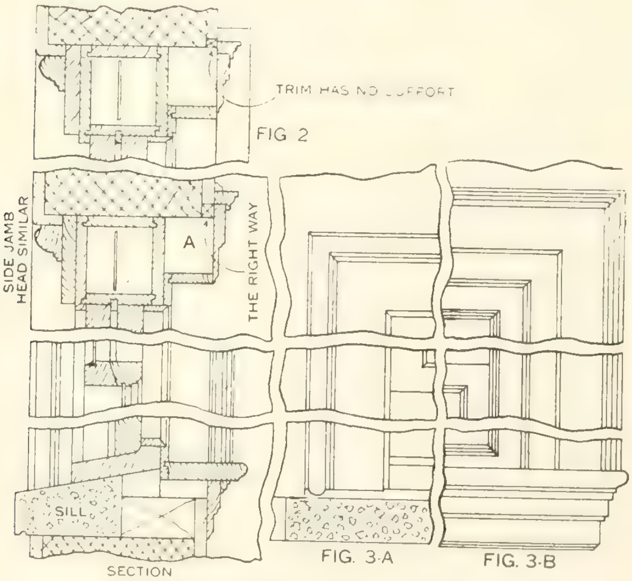
Detailing of Frames for Modern Residences

MANY of the more pretentious residences of the present time are built of hollow-tile and stuccoed on the outside. Owing to this hollow-tile wall, the window frames must necessarily be constructed in a somewhat different manner than are the frames for a brick wall, says John Wavrek, Jr., in The Woodworker. Having come in contact with various makes of these frames, it seems to me that a description of some of them would be of interest.



Dormer window with casement sash swinging inward.

There is a tendency at present to have most of the second and third floor inside finish in white. Where this is the case it is desirable to use basswood or poplar trim, which is very suitable for a white finish. The pulley stiles, however, should be made of some harder wood; yellow pine is used very extensively for this purpose. In order to show the inside finish alike it is necessary to construct the frame so that this result is obtained. In the sketches herewith several different kinds of trim are shown as applied to modern buildings.



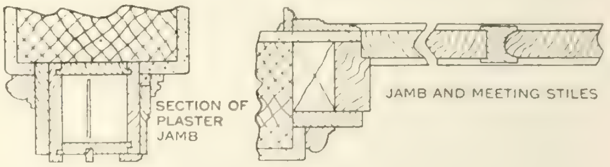
Window frame for hollow-tile wall.

Fig. 1 shows the method of building a dormer window having casement sash which swing inward. The discussion of this particular frame in various journals, from time to time, has no doubt resulted in producing a good casement frame. When the sash is hung on hinges at the sides, so as to swing outward, it is an easy matter to construct a water-tight frame, comparatively speaking. But there is an objection to such a frame, for it is unhandy in case it is desired to put a fly screen on the outside. The dormer frame shown is designed to fulfil this requirement. The sash swing inward, and the method of construction is such that the frame gives good satisfaction. Fig. 1-A shows part outside, and Fig. 1-B part inside elevation.

Although the casement frame is used quite often (and it has some features which appeal to most people), the double-hung frame possesses several advantages over it, and for my part I very much prefer the latter. But since the casement frame is still with us, and no doubt will be for some time, it is well to make it in the best possible way.

In Fig. 3 is shown a double-hung window frame of special make, designed for a hollow-tile wall with stucco finish outside. Fig. 3-A shows part outside, and Fig. 3-B part inside elevation. Owing to the large size of the sash the frame requires a large weight-box. In this case the reveal on the inside is 6¾ in. from wall line to jamb.

Fig. 2 shows a faulty inside trim as it was actually done on a job which we furnished a short time ago. The inside casing was plowed as shown, and naturally the trim had no support to which it could be nailed. Of course, blocking could have been provided whereon to nail it, but the contractor objected to this extra work. The result was that we plowed the casing farther back, and thus overcame the difficulty, as shown at A, Fig. 3.



Window frame for bathrooms, etc., and section of French window.

Another style of inside finish is shown in Fig. 4. In this case the jamb is plastered to the weight box of the frame; the small wall mould takes care of any inequality in the plastering. This style of window frame is suitable for bathrooms, toilets and bedrooms.

The French window frame is also extensively used in the better class of houses. The make-up of the frame is of the same design, practically, as the door frames. The sash, which are usually in pairs, have the meeting stiles made in various ways, either rabbeted or with an astragal joint, as shown in Fig. 5. I hope that this article will be instrumental in bringing up a discussion on the important subject of frames for modern residences.

The amount of polish which can be given to the surface of concrete depends upon the density and the nature of the aggregate used. After the surface has been smoothed down on a rubbing bed, or by the use of rotary rubbing stones, as applied in terrazzo floor work, the procedure is somewhat similar to that used in polishing granite or marble. The aggregate exposed on the surface by the rubbing process takes the polish, the appearance of the surface being dependent upon the percentage of aggregate exposed.

One-Course Method Reduces Asphalt Patching Costs 15 Per Cent.[*]

In the repair of the ordinary sheet asphalt pavements which consist of a binder course and wearing surface the usual methods of using the two courses in making repairs has always seemed to me unnecessarily expensive, necessitating as it does the making of one operation in laying the binder course, and then going all over the work again in putting on the wearing surface.

In a day's work of repairing asphalt pavements, the ground covered frequently extends over several blocks, and in the case of repairing cuts made by the installation of public utilities in the newer paved districts, the repair work may extend over miles in a day's work. This not only makes two operations for the street crew, in fixing each cut, but causes an increased plant expense in handling the larger sized material aggregate for the binder course during part of the day, and then changing over to the finer aggregate for the wearing surface.

Every superintendent familiar with asphalt repair work realizes the difficulty in estimating the amount of material required for just the right amount of top or binder for a day's run on patch work, and therefore it is often the case that the plant foreman will prepare more binder than can be used or run the risk of not having enough. To repair sheet asphalt pavements by the "once over" method I have used in our work here for some time past an asphaltic concrete mixture of the following amount of asphaltic cement and mineral aggregate, and have had most excellent results with the same.

Asphaltic Mixture for Patch Work

	Per Cent.
Asphaltic cement	9
Mineral filler passing through 200-mesh sieve	5
Sand passing through 80-mesh sieve	10
Sand passing through 40-mesh sieve	25
Sand passing through 10-mesh sieve	15
Crushed rock passing through ¼-mesh sieve	26
Crushed rock passing through ½-mesh sieve	10

Screens used in the order named.

The cut or worn place in the pavement to be repaired is prepared in the usual manner by cutting away the defective material until a good joint can be secured in the sound pavement and then carefully trimming the edges of the cut and painting with pure hot asphalt. If the patches are unusually large or located on a grade where there might appear to be danger of the patches creeping on the base, I paint the concrete base with a hot asphaltic paint consisting of 80 per cent. asphalt and 20 per cent. distillate, and then proceed to fill the holes as prepared above with the hot asphaltic concrete mixture the same as is done with sheet asphalt, using special care in tamping and smoothing the joints and securing the maximum amount of compression by rolling, and finally dusting with cement.

It is well to have the mixture to be used fairly hot, at least 300 deg. Fahr., in order to secure thorough compression by tamping and rolling.

This method might appear objectionable on the grounds that the patches made with the asphaltic concrete mixture would plainly show in contrast to the sheet asphalt pavement. However, this is not the case, and a few days after the patches are put in they are not distinguishable from the original pavement, and by this method I have been able to decrease our cost of maintenance from 15 to 20 per cent.

Railroad construction at night is made possible, says a scientific journal, by the use of a freight car as a lighting plant. Projecting from a tower built at one end of the car is a light arm that extends far out over the track. At the extreme end of this arm two searchlights are placed, while other lamps are located at intervals along the arm. By means of this arrangement plenty of light can be shed upon the portion of the track that the arm overhangs, while beams of the searchlights can be cast ahead where the work of preparing the roadbed is under way. The lighting plant permits of carrying on work in the cool hours while the torrid sun is below the horizon.

Tests of Fireproofed Wood

At the recent annual meeting of the National Fire Protection Association, the Committee on the Uses of Wood in Building Construction presented an extended report dealing with tests made of wood treated with various fire-retarding compounds at the Government Forest Products Laboratory in Madison, Wis. These tests were made under the direction of Robert E. Prince and included also tests of the relative inflammability of various species of wood untreated and of various paints claimed by their manufacturers to have a fire-retardant effect.

The conclusions arrived at as a result of the tests may be briefly summarized as follows: The widely held idea that certain kinds of lumber are much more resistant to fire than others was not supported by the results of Mr. Prince's tests. It should be said, however, that his tests were made on the soft woods such as are in general use for building construction. It is of course recognized that the hard woods are less easily ignited than the woods from most evergreen species, but this is not a fact of practical importance, since the hard woods are generally unsuitable for exterior use.

Turning to the tests on lumber fireproofed with various chemicals, it was found that some of these chemicals injured the strength of the wood or discolored it, and had a corrosive effect on the cylinders used for treating. The best results in fire retardation were obtained from wood treated with ammonium salts and sodium borate. These chemicals are obtainable at prices which are not a serious handicap to the use of wood treated with them. The fire-retardant paint tests showed that a number of these paints have considerable value in decreasing inflammability, especially those which are designed for interior use. Extended tests were made also with various methods for reducing the inflammability of shingle roofs, and it was found to be practicable to effect this by various methods at a reasonable cost.

In an excellent paper on "The Protection of Ancient Buildings," prepared for the Annual Conference of the Institution of Municipal and County Engineers, Mr. W. A. Forsyth, F.R.I.B.A., gives a valuable summary of the various means at the disposal of the architect for the purpose indicated. The advantages of cement grouting receive due recognition and reference is also made to the aid that can be rendered by reinforced concrete in the repair of masonry and brick work.

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[*] By F. N. Bingham (Spokane, Wash.) in the Engineering Record.

Cost of Brick Pavement

THE cost of a brick pavement may be determined roughly by a formula given in a bulletin published recently by the United States Department of Agriculture. The cost of such a pavement, it is pointed out, depends so much upon so many variable factors, such as the locality, freight rates, and the distance from brick kilns, that it is not possible to make any definite estimates. The cost of the rough grading, however, should be considered entirely apart from the cost of the pavement, for the grading would have to be done no matter what kind of a road was to be built. Excluding this item, the bulletin furnishes the following formula as a rough guide for the probable expense of a brick road with a 6-in. concrete foundation and suitable grades: Cost per square yard equals 1.90 L plus 0.213 C plus 0.138 S plus 0.157A plus 0.040 B. In this formula C equals cost of cement per barrel, S equals cost of sand per cubic yard, A equals cost of coarse aggregate per cubic yard, B equals cost of paving bricks per 1,000, and L equals cost of labor per hour. It is assumed in this formula that all materials are delivered on the work. About 10 per cent. should be allowed for wear on tools and machinery, and for every inch subtracted or added to the thickness of the foundation there will be a corresponding difference of 8 to 12 cents per square yard.

Novel Method of Excavating for Caisson Foundations

THE methods and equipment used in constructing the caisson foundations for a bank building in Stockholm, Sweden, proved so effective and were so unusual as to warrant special mention by our Chicago contemporary, Engineering & Contracting. At one side of the building site the depth to bedrock was only about 10 ft. The rock surface shelved rapidly, however, and at the opposite boundary rock was encountered at a depth of about 60 ft. below the street level, or about 45 ft. below the ground-water level. The subsoil consisted principally of water-bearing sand and gravel, mixed with clay and boulders, in which the flow of water was so great that it was practically impossible to pump it. Moreover, it was deemed unsafe to lower the natural water level on account of endangering the foundations of adjacent buildings. To meet these conditions the following methods were devised:

Sectional caissons of reinforced concrete were constructed, circular in form, each section having an inside diameter of 7 ft., a height of 2 ft. 8 ins., and a thickness of 5 ins. The sections were provided with marginal recesses and with cored holes, through which passed the vertical rods used to fasten the sections together. The lower section, which was 6 ft. high, was provided with a steel cutting edge and with a steel lining, to protect it while the rock surface was being levelled by blasting. In excavating the subsoil within a caisson the material was loosened with a water jet and was removed through a suction hose, both of which were operated from the bottom by a diver. The excavated material was delivered through the suction hose and through a centrifugal pump into a settling basin, from which the water was drained off over a weir and conducted back through a flume, to the caisson. Where large stones and boulders were encountered they were hoisted, but stones as large as 4 inches in diameter were brought up in large quantities through the suction hose and pump. To facilitate the sinking of the caissons the motor-driven air compressor, used to furnish air for the drilling machines, was set up on top of a caisson as the latter was being sunk. The compressor vibrated considerably and the results obtained by its use in this manner were very satisfactory. After the caisson reached bedrock, the surface was levelled, by drilling and blasting, and the caisson was filled with concrete, deposited under water.

The contractor in charge of this work reported that the methods adopted proved both rapid and economical. We believe that equally satisfactory results can be obtained in many part of this country. The use of similar methods in constructing the foundations of bridges and buildings, especially in water-bearing soils where there is likelihood of a settlement of adjacent structures, should prove both effective and economical.

Personal Mention

Mr. George Henderson has been appointed president and general manager of Brandram-Henderson, Limited, in succession to his father, the late Mr. Joseph R. Henderson.

Mr. J. R. Macleod, who for some years has been in charge of municipal railways and tramways for Montreal, has now been given charge of the sewers department of that city.

Lieut.-Col. A. E. Hodgins, who has been connected recently with the British Columbia Department of Public Works, is organizing a corps of Royal Engineers in British Columbia.

Mr. G. R. G. Conway, M. Inst. C. E., M. Can. Soc. C. E., late of Vancouver, has opened offices at 409 Royal Bank Building, Toronto, for consulting practice in civil and hydraulic engineering.

R. H. Murray, A. M. Inst. C. E., Resident Sanitary Engineer for the Province of Saskatchewan, has received an appointment with the Overseas forces under the British Army Medical Corps. He sails for England on August 28th.

Mr. Murray Stewart, Roadway Engineer in the Toronto Works Department, was presented with a handsome set of silver last week on the occasion of his marriage. The presentation was made by Mr. William Barber, head of constructural operations, on behalf of the employees of the Roadway Department.

Mr. H. S. Philips has been granted leave of absence from his duties in the City Engineering Department at Toronto to accept the position of Assistant Engineer in the Buffalo, N. Y., office of the International Joint Commission, under the direction of Prof. Earle B. Phelps, of the United States Public Health Service. A part of the work of this Commission is the investigation of a means for the control of the pollution of the Niagara River.

The following civic corporations and Montreal contractors, engineers, builders' supply, and allied firms have intimated to employees intending to enlist that their positions will remain open until their return:—Cities of Montreal, Westmount, Outremont, and Maisonneuve, National Brick of Laprairie, E. G. M. Cape, Limited, the Pedlar People, Limited, Canada Cement Company, A. Ramsay and Son Company, Brandram-Henderson, Limited, the Garth Company, Canadian Consolidated Rubber Company, Canadian Fairbanks-Morse Company, Robert Mitchell Company, Canada Paint Company, Alex. McArthur Company, C. H. Johnson and Sons, Limited, Miller Bros. Company, Limited, Asbestos Manufacturing Company, and Geo. W. Reed and Company.

American Manufacturers Honor Canadian

A number of leading American manufacturers, such as the Winchester Repeating Arms Company, the Yale & Towne Manufacturing Company, the Pillsbury Flour Mills, Armour & Company, and thirty-six others of equally high standing, members of an organization known as the Rice Leaders of the World Association, have conferred a high honor on one of Montreal's business men. Rather more than a year ago, they offered nearly 3,500 cash prizes for ideas and suggestions. This was open to anybody, and the ideas and suggestions could relate to production, sales, advertising or anything else. The object of the offer was to develop suggestions that would tend to improve the methods or products of these American manufacturers. Only one idea could be submitted to each manufacturer, no two ideas could be alike, and each idea had to be compressed into fifty words.

Thousands of Americans entered this contest, together with a few Canadians, Britishers and foreigners. The Second Prize of $500 cash has been won by a Canadian, Mr. R. W. Ashcroft, of Montreal, Manager of Publicity for the Canadian Consolidated Rubber Company, Limited, and associated companies.

In presenting him with the prize, Mr. Elwood E. Rice, President of the Association, wrote Mr. Ashcroft as follows: "To have earned this Second Prize in this international competition where people in all walks of life from all parts of the world entered, is certainly a great evidence of your unusual ability, and in which you are indeed justified in taking exceptional pride. I extend to you my best wishes for the continued success your able efforts so richly deserve."

This is not only a feather in Mr. Ashcroft's cap, but is also a compliment to the business ability of Canadians, particularly in view of the fact that Mr. Ashworth only heard of the contest a few weeks before it closed last May, and therefore had but very little time in which to compile and submit his ideas.

No special publicity was given to the contest in Canada, so that those resident in the United States, who had a whole year in which to evolve ideas, naturally had a better opportunity than Canadians to compete successfully.

The Steel of Canada Company has been making remarkable headway in shell-making, according to official advices. Orders obtained by the company from the Shell Committee called for something like 650,000 shells, and out of the 605,000 delivered to date rejections only amount to the insignificant number of 62, making an almost perfect showing for the plant. Why the officials are particularly pleased with the result is that it was only in February that they started on the erection of the plant which is being used for the manufacture of shells, and the entire plant is manned by the company's own men, who have turned from their ordinary work to the special lines that are now being required.

Pedestrian traffic is now passing through the new Main Street subway, under the railway track, at Moncton, N.B., the work having been practically completed. Messrs. Soper & McDougall, the contractors, have made rapid progress with the work, considering the bad weather they have had to contend with during the summer.

Aztec Company's Important Contract

The city of Montreal has awarded a contract to the Aztec Oil and Asphalt Refining Company of Canada to supply and apply Aztec asphalt road binder, on the penetration method, for surfacing in the neighborhood of 300,000 yards of roads, all to be completed this season. Although the Aztec Company's price was slightly higher than some of the other bids, the company were awarded the contract after a test of a sample submitted to a committee of four experts for test in competition with samples from other manufacturers. This committee was composed of Dr. Milton Hersey; Mr. Crossley, of the Donald Laboratories; Mr. French, of McGill University; and Mr. Haynes, of the Polytechnic School. Mr. Paul Mercier is the acting chief engineer of Montreal. The Aztec Company are equipped with the necessary pressure distributors to complete about 5,000 yards per day, and have guaranteed their work for two years. Several thousand tons of this material are used yearly for similar work throughout the United States with highly satisfactory results.

Mr. A. W. Ashcroft, of Montreal.

Mainly Constructional

East and West From Coast to Coast

J. H. Wallace and Company, Limited, Montreal, is a new company incorporated with a capital stock of $20,000, to carry on business as engineers, architects and contractors. The incorporators include Messrs. K. Archibald, S. L. D. Harriss and R. McGillivray.

A report from St. Marys, Ont., says that plans are under way for doubling the capacity of St. Mary's cement plant, and it is believed that inside the next twelve months another cement plant will be started. A number of houses are also in course of construction here.

Of the larger jobs in prospect, mention may be made of two sheds, estimated to cost $250,000, to be erected in connection with the harbor development work at Vancouver by the Dominion Government. The buildings will be 700 feet by 80 feet in dimensions, of structural steel construction.

Latest reports from Vancouver tell us that the New Westminster five-million-gallon storage reservoir, which is adjacent to the present high level track, is now practically completed, and will provide an added safeguard against shortage on the upper levels of the city for fire protection purposese.

A new company has been incorporated at Montreal under the title of Hubert Villeneuve, Limitee, with a capital of $50,000, and will carry on business as contractors and builders. The incorporators are Messrs. H. Villeneuve, J. H. Carpentier, W. J. B. Johnston, Rodrigue Gauthier and Raoul Villeneuve.

The corporate name of The Marion-Osgood Company, Marion, Ohio, has been changed to The Osgood Company. For some time the firm used the trade name "Osgood" on their shovels, dredges, and other excavating machinery, and the change in name has been made in order to conform to this trade name.

Dr. Broadfoot has commenced work on the erection of his new 30 x 40 ft. elevator, near the leading platform on the C. P. R. spur at Redcliff, Alta. Excavating for concrete foundation and the erection of the engine house are now under way. When completed, the elevator is to hold 9,000 bushels, consisting of 9 bins with a capacity of 1,000 bushels each.

The claims against the city of Prince Albert, B. C., of the Ambursen Company and Walker & Company have now been settled for $70,500. In April last the two companies entered action against the city in connection with the La Colle Falls scheme, amounting to $100,000. After obtaining legal opinion the Council decided to negotiate a compromise settlement, which has now been completed.

In the British Columbia Appeal Court recently, McIlwee Brothers, contractors, of Denver, Colo., won their appeal for half a million dollars judgment against Foley, Welch & Stewart, contractors for the Rogers Pass Tunnel. The plaintiffs sued for $527,000 damages for alleged breach of contract. The trial judge in the Appeal Court allowed them only $30,000, but the higher court added approximately half a million to the judgment.

The first length of pipe of the Bathurst, N.B., water and sewerage system was laid recently by Mayor Michaud, with appropriate ceremony. A. R. C. Clark & Son, of St. John, N. B., are the contractors, and are now well ahead with the work. A modern trench digger is being used, and work is advancing rapidly with the aid of this machine. The engineer is Mr. T. H. Higginson, of Montreal, later appointed Consulting Engineer.

Welland, Ont., is fortunate in securing the first Canadian reduction plant to be started in Canada. It will be in operation, it is expected, before next November. The newly incorporated Canadian Zinc Company, owned by the Weedon Mining Company, has acquired a large industrial plant in Welland, and has entered into a contract with the Hydro-Electric for an initial allotment of 1,000 horse-power. This will make Welland's first electric smelting plant.

The corner-stone of the new St. Vincent de Paul Church, situated at the corner of Roncesvalles and Westminster Avenues, Toronto, has now been laid. When completed the structure promises to be a very beautiful one, being of Grecian architecture and built of Indiana and Queenston stone. The cost of construction is estimated at $80,000, and the building will be 60 feet wide and 160 feet long, with a basement 11 clear feet in depth. Completion is expected in October.

The year's programme of sewer construction at Regina is now completed, and the city has 67¾ miles of water mains, including storm sewers and 73¼ miles of water mains, including the supply mains from Boggy Creek. With the exception of some of the painting and the construction of the doors and windows, the large new rectangular filter bed at the disposal works here is also completed, and the travelling distributors are already busy scattering sewage on the rocks which comprise the bed.

The Montreal Builders' Exchange have sent a letter to the Mayor protesting against a proposed referendum on the subject of changing the city's form of government. The Mayor objects to the present system of Controllers, and is hopeful that a referendum will be favorable to his views. The Exchange oppose the taking of a vote because of the economic and financial disturbance caused by the war; because the acts of individual controllers are liable to be confused with the Board of Control system; because of the expense; and also because the congested state of the city's affairs is not conducive to a clear and intelligent handling of the question.

The month of July saw the completion of the pioneer heading at the Rogers Pass Tunnel on the Canadian Pacific Railway near Glacier, B. C. At the same time the greatest progress for the job in enlarging the main heading for double track was made, 812 ft. of the west end of the tunnel having been excavated and timbered during July. The largest month's progress of enlargement for double track on the east end, 726 ft., was also recorded for the month of July. The best progress on the pioneer headings was 808 ft. for June and 932 ft. for January, 1915, both made in the west heading. This last figure is the American record for progress in any sized tunnel. The best month's work in the east pioneer heading was 776 ft. for June, so that June was the high month for the pioneer bore, with 1,584 ft. of progress made in both headings.

Another Improvement in the Construction of Creosoted Wood Block Pavements

By many authorities on municipal engineering, wood block paving is regarded as one of the best existing, when its wearing qualities and the cost of laying it are taken into consideration. It is as smooth as sheet asphalt, it is noiseless, elastic and sanitary. It wears evenly and is easily repaired, but construction methods as they now exist have given it its share of disadvantages as well as other forms of paving. If laid close together the blocks form a surface that is so smooth as to be slippery on account of the oil that bleeds from them. Manufacturers are developing means of overcoming the bleeding trouble, but in wet weather the blocks are almost as slippery as asphalt. Then, too, the wood block pavement is often subject to severe displacement on account of the expansion of the blocks. This often causes the pavement to heave up from its foundation under the internal strains set up by the expansion, necessitating extensive repairs. Even under these adverse conditions this form of pavement is popular, and the city of Detroit awarded contracts for 145,000 yards of wood block paving recently.

The remedy for the slipperiness of the pavement and one which provides for the expansion of the blocks at the same time is the allowing of a space between each block, to be filled with a suitable material that will be easily compressed when the blocks expand. It is the question of facilitating the laying of wood blocks with even joints between each block to take the expansion filler that has been engaging the attention of wood paving block manufacturers for some time now. In one case the blocks have been milled with lugs on the sides, but in order to leave these lugs projecting beyond the body of the block it has been necessary to cut away a lot of the wood to waste.

Now another means of spacing the blocks has been brought out by a Walkerville inventor, Mr. Harry E. Warden. The fundamental construction of this new type of pavement is illustrated in the accompanying sketches. By the use of the nails, which are about the size of lathing nails, there is no waste of wood in providing space between adjacent blocks. There is even a saving of wood, for it is unnecessary to have all the blocks machined down to one size. Arrangements have been made to get a machine that will drive the nails—at the rate of 80 a minute—to a set distance from the opposite face of the block. If the block is over size the nails will not project so far from the face into which they are driven, and if it is under size the nails will project further, thus making the size of each block the same when measured over the heads of the nails. This makes for a great saving in the cost of the lumber for the blocks, since lumber of millrun sizes is much cheaper than lumber dressed to size.

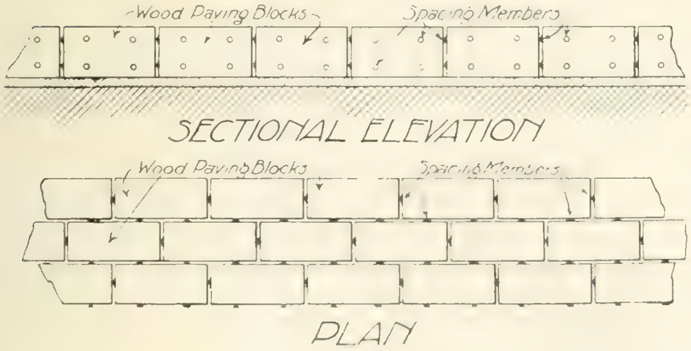


Fig. 1

Included in the patent covering this type of paving is a special shape of spacing member, which not only sets the space between the blocks, being driven in the same way as the nails, but also interlocks with corresponding members on the adjacent blocks. In this way any load applied to an individual block is distributed through the interlocking members to the other blocks comprising the finished pavement.

To prevent tar or other joint filling material from injuring the spacing members and making it difficult to repair the pavement or to use the blocks over again, a sleeve is provided to cover the spacing members, as shown in the drawing. This sleeve fits over the heads of either the nail or interlocking type of spacing member, so that it is impossible for any of the filler, whether cement or asphaltum, to come in contact with them.

The invention marks an important development in constructional practice in connection with wood block pavements. It overcomes what have been rather serious disadvantages of this form of paving; its slipperiness, which is done away with by the openings between each block, which provides foot hold for horses, and its liability to deformation, which is prevented by the strip of compressible material between each block.

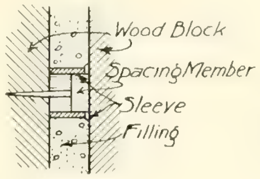


FIG. 3

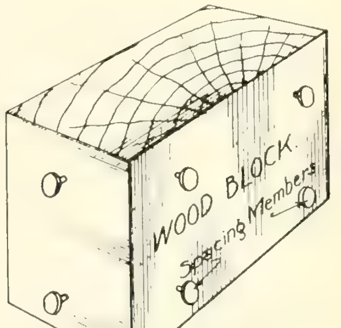


FIG 2

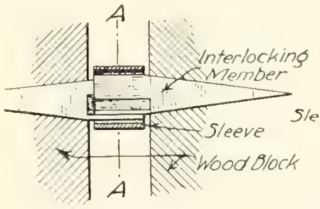


FIG. 4

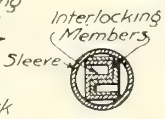


FIG 5

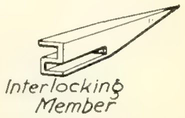


FIG. 6

Tenders for Sheet Steel and Steel Bands

Hon. Phillipe Roy, Canadian Commissioner General at Paris, has forwarded to the Trade and Commerce Department communications from the Engineer of Equipment and Traction of the Paris-Lyon-Mediterranee Railway, with reference to the probability of Canadian manufacturers being in a position to tender for 600 tons of sheet steel, classes C, D, and E, for current uses, and 200 tons of sheet steel classes A and B, for boilers. Net prices are requested per 100 kilos for each of these classes of sheet and by thickness, the prices quoted to mean goods delivered free of all transportation charges, customs duty or other expenses, and loaded on cars in a station of the above mentioned railway system. A table, indicating the maximum simultaneous dimensions (length and width) which the Canadian plant can roll in various thicknesses is also asked for, together with the delays of delivery, which the company would undertake to observe.

The Paris-Lyon-Mediterranee Railway Company has also the intention of entering into a contract for the supply of 1,500 to 1,800 tons of steel bands, classes B and C, for locomotives, tenders, passenger and freight cars, which it will require during a period of six months. The deliveries of this item are asked to be made according to the needs of the Paris-Lyon-Mediterranee Railway Company on the dates indicated by them, and according to the special orders, which will be forwarded to the sellers two months in advance and which will indicate the types and number of steel bands to be supplied. Specifications and drawings for these tenders when received, may be inspected at the Department by Canadian firms, who may desire to do so. The date originally fixed for the closing of the tenders was July 31, but as the P.L.M. Co. has apparently not received sufficient proposals to meet its requirements, the time will in all probability be extended, in order to allow Canadian firms to compete. Further advices are being awaited from the office of the Canadian Commissioner General at Paris and any additional information will be referred to interested manufacturing companies, after its transmission to the Department of Trade and Commerce, Ottawa.

Underground Conduit Exhibition

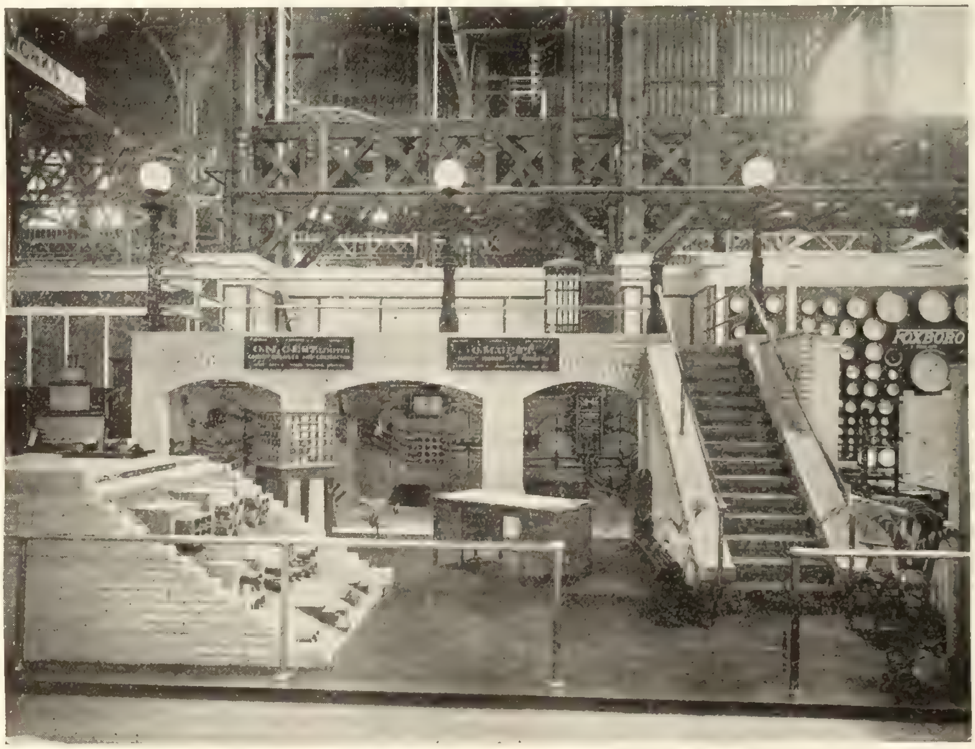
Among the Canadian exhibitors at the Panama Pacific Exposition at San Francisco is G. M. Gest, Limited of Montreal, Winnipeg and Vancouver. This exhibit while interesting to all, is instructive as well, and has attracted widespread interest, not only among those in electrical work, but also in everyone devoted to civic welfare. It has been the hue and cry in many cities to remove all overhead wires, and in this exhibit everything is shown pertaining to the underground which takes the place of the unsightly overhead.

Mr. Gest has made a specialty of underground conduit construction for many years, and has been identified with many of the largest installations of conduit and ornamental street lighting in Canada. In addition to the construction, Mr. Gest has done considerable engineering throughout Canada. Quebec, Montreal, Toronto, Ottawa, Winnipeg, Vancouver and Niagara Falls, have all benefitted by having this class of work installed by his organization. In most of these cities this organization has not only completed contracts for corporations, but for municipalities as well.

In recognition of what Mr. Gest has done in developing conduit systems, and for his methods of installation, the International Jury of Awards at the Exposition, has awarded his organization a gold medal, the highest award in his class. The exhibit, occupying about nine hundred square feet in the Palace of Machinery, comprises systems of underground conduit and cable construction, and shows the different materials, apparatus and methods of construction of the underground conduit and cable systems, and distribution systems wherein armoured cable is used. Everything for the distribution of electrical energy—light and power, signalling and communication—are presented in an attractive form. The various methods of installing underground conduit for draw-in systems are shown, including fibre, pump log, (creosoted wood) iron pipe, and clay conduit in both single and multiple, square and round bore type. Also methods employed in Europe including that known as the "trough system," using cast iron, asphalt and tile trough. Of the solid systems are shown armoured cable laid direct in the ground, also the Edison tube system.

Manholes are represented in telephone, light and power, also the transformer vault; these are in brick and concrete construction. Shown complete are the various forms of apparatus for the proper distribution of electrical energy for the several systems, such as transformers, junction boxes, cutouts, switches and cable terminals, all technically installed. In addition to the cable and other apparatus installed in the manholes are shown a street pillar and kiosk, also an ornamental lighting system with method of feeding, by means of underground distribution systems.

Augmenting the practical side of the installation of underground work described, drawings are shown of the plans for complete underground systems, also a collection of lantern slides, showing special features of construction, also lighting systems in various parts of this continent and Europe. As an exhibit, it is very interesting and instructive to all.



San Francisco Exhibit of G. M. Gest Limited.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Barrie, Ont.

The Town Council are about to construct a vitrified tile sewer on Mary Street by day labor. Engineer, C. K. S. Macdonell.

Dorval, Que.

A tar macadam road is being laid on Main Street by day labor, at an estimated cost of $30,000. Material has been purchased. Engineer, Z. J. Venette.

Enniskillen Township, Ont.

The Township Council have decided to enlarge and extend the Morrison Drain, and make repairs to others. Work will commence shortly. Engineer, G. V. Wyant, Petrolea, Ont.

Essex, Ont.

The Town Council contemplate laying concrete pavement on a portion of Center Street. Clerk, R. R. Brett.

Guelph, Ont.

The City Council have had plans drawn for extensions to the waterworks system. Work will include six spring basins, ten manholes, and the construction of a reinforced concrete reservoir. Approximate cost, $24,300. Engineer, F. McArthur.

Halifax, N.S.

The City Engineer, F. W. W. Doane, has completed surveys for a large quantity of concrete sidewalks, to be laid at an estimated cost of $71,400. Work by day labor. Wheelbarrows, shovels and a concrete mixer will be required.

Leamington, Ont.

Tenders will be received until September 6th by the Town Clerk, R. M. Selkirk, for the construction of a concrete pavement on Erie Street. Plans and specifications at office of the Clerk and of the Engineer, J. J. Newman, Ouellette Avenue, Windsor.

London, Ont.

The City Council have authorized the construction of cement sidewalks, curbs and gutters, asphalt pavements and gravel roadways on a number of streets. Clerk, S. Baker.

A by-law has been passed by the City Council providing for the construction of sanitary sewers on Quebec and Salisbury Streets, at an approximate cost of $3,300. The laying of a tile sewer on Inkerman Street has also been authorized.

North Vancouver, B. C.

The Municipal Council have instructed Engineer A. M. West to report on the construction of an 8-inch watermain on a portion of Seymour Street. Clerk, J. Cowlins.

Norwich North Township, Ont.

The Township Council have passed a by-law for the construction of the Burtis Perry Drain. Clerk, C. E. Burgess, Burgesville.

Peterborough, Ont.

The construction of cement sidewalks on Prince, Oxford, Donegal East and Dublin Streets has been authorized by the City Council. Engineer, R. H. Parsons.

St. Thomas, Ont.

The construction of a concrete pavement on Elgin Street has been authorized by the Town Council. Engineer, M. Ferguson.

Stratford, Ont.

The City Council are considering the construction of a sewer in Avalon Park and on Home Street, and the laying of sidewalks on Mowat and Birmingham Streets. Clerk, R. R. Lang.

Thorold, Ont.

The Town Council are about to construct sewers on Carleton, Lyndon and West Streets by day labor. Approximate cost, $3,300. Work to be done under supervision of the Resident Engineer, J. F. Henderson.

Toronto, Ont.

Tenders on the construction of asphalt pavement on Bloor Street west of Dundas and of a brick block pavement on Indian Road will be received until August 31st by the Board of Control. Plans at the office of the Works Department, City Hall.

York County, Ont.

County Engineer E. A. James, 57 Adelaide Street E., Toronto, is preparing estimates for the construction of about 25 miles of road work and a number of culverts in the northern part of the County.

CONTRACTS AWARDED

Barton Township, Ont.

The Township Council have let a contract for laying concrete sidewalks and curbs to Charles Brayley, Gibson Avenue, Hamilton. Approximate cost, $5,000.

Blenheim, Ont.

The Town Council have let the contract for the construction of concrete sidewalks to John Scoyne, Blenheim, and for curbs to T. E. Tifft, Blenheim. Estimated total cost, $4,000.

Dundas, Ont.

The Public Utilities Commission have let the contract for the construction of a storage dam at Greensville to the Dickson Building Company, King St., at $4,750.

Dunnville, Ont.

A contract for laying about 6,000 square yards of tarvia macadam paving and 4,000 feet of curbing has been let by the Town Council to McRae & Compaigne, Niagara Falls, at $10,460.

Edmonton, Alta.

The contract for the construction of a watermain to the site of the stockyards has been let to W. J. Graham, 82 Corey Street.

Leamington, Ont.

The contract for laying a sewer on Talbot Street has been let by the Town Council to Anson Smith, Chairman of the Board of Works. Cement or salt glazed tile will be used.

Lennoxville, Que.

Work has been started on the construction of a water system in connection with Bishops College. General contractors, Eastern Pipe & Construction Company, Limited, 128 Bleury Street, Montreal. Approximate cost, $5,000.

Port Elgin, Ont.

A contract for laying about 4,000 square feet of concrete sidewalk has been let by the Village Council to Thomas Brigden, at 7¼c. per square foot.

St. John, N.B.

The Municipality of the City and County of St. John have let a contract for laying sewers to Kane and King,, Prince William Street, and for the supply of material to Vroom & Arnold, Robinson Building, Market Square.

York Township, Ont.

The Township Council have let the contract for laying concrete sidewalks on Markham Street and Westwood Avenue to the Riverdale Concrete Paving Company, 264 Jones Avenue, Toronto, and to William Bushell, 6 Westminster Avenue, Toronto, for sidewalk on Priscilla Avenue.

Railroads, Bridges and Wharves

Chatham Gore Township, Ont.

Tenders on the construction of a concrete bridge will be received until noon, September 2nd, by Commissioner W. Bidens, Lot 3, Concession 1, Wallaceburg. Plans and specifications with the Commissioner.

Nova Scotia Province

Tenders on the construction of a bridge and culverts in Victoria County will be received until September 4th by E. H. Armstrong, Commissioner of Public Works and Mines, Halifax. Plans and specifications at the Department, Halifax.

St. Catharines, Ont.

Tenders will be received until September 2nd by the Chairman of the Bridge Committee for 4,400 square yards of creosoted wood block pavement on concrete foundation, and 13,315 square feet of reinforced concrete sidewalk, to be laid on the St. Paul Street Bridge. Plans and specifications at office of the Engineer, W. P. Near.

West Nissouri Township, Ont.

The Township Council have authorized the laying of concrete floors on two bridges and repainting of several others. Clerk, J. H. Davis, Belton, Ont.

CONTRACTS AWARDED

Grey County, Ont.

The County Council have let the contract for the erection of bridges Nos. 1

and 3 to James Cole, Owen Sound, and for bridge No. 2 to Clark & Jones, Owen Sound. Concrete construction.

Haldimand County, Ont.
A contract for the construction of four concrete bridges has been let by the County Council to R. E. Duffy, Dunnville, at $3,977.

Huron County, Ont.
The general contract for the construction of a concrete and steel bridge between Goderich and Hullett Townships has been awarded by the County Council to Joseph Lawson, Crediton, Ont.

Public Buildings, Churches and Schools

Ashton, Ont.
The construction of the Anglican Church is nearing completion. Seating has not yet been purchased. Pastor, Rev. S. B. Holmes.

Clinton, Ont.
The erection of an addition to the Model School is contemplated by the Trustees. Approximate cost, $6,000. Secretary, C. D. Bouck.

Montreal, Que.
The Kensington Presbyterian Vestry are contemplating an addition to the Church in Notre Dame de Grace Ward. Frame construction, concrete foundation. Particulars from J. A. Veitch, 208 McGill Street.

Newcastle, N.B.
Tenders on heating, plumbing and electric wiring at the Miramichi Hospital will be received until August 28th by J. E. Edgett, Box 104.

Pembroke, Ont.
Plans of a Town Hall are being prepared by the Department of Public Works, Ottawa. Secretary, R. C. Desrochers, Ottawa.

Peterborough, Ont.
Tenders for alterations to the Y. M. C. A. building at 475 George Street will be received until August 28th by the Architect, W. Blackwell, 372½ Water Street. Separate tenders on plumbing and electric wiring will be considered.

Port Arthur, Ont.
Sundry repairs to the Municipal Buildings are being considered by the City Council. Work consists of repairs to roof and placing of steel columns in the Hall. Engineer, L. M. Jones.

Quebec, Que.
Tenders on the erection of a Grand Stand at the Provincial Exhibition of Quebec will be received until September 1st by Tanguay & Lebon, Architects, 20 d'Aguillon Street.

Smith Township, Ont.
The Township Council are about to issue debentures to the amount of $3,000 for building a school in Section No. 9. Clerk, J. W. Kelly, Bridgenorth.

St. Emelie, Que.
Tenders on the erection of a school will be received until August 30th by the Secretary to the School Commissioners, D. L. Filteau. Plans and specifications with the Secretary. Brick construction, concrete foundation.

Tecumseth Township, Ont.
Tenders on the erection of a school in Section No. 4 will be received until September 1st by the Secretary, John Harvey, Cookstown. Plans at residence of Barry Jebb, Newton Robinson.

Toronto, Ont.
A report has been presented to the Property Committee placing the cost of a new tile roof on the City Hall at $30,000. Property Commissioner, D. Chisholm.

Trenton, Ont.
Alterations to Grace Methodist Church, Dundas Street, are being considered. Brick construction, shingle roofing. Estimated cost, $5,000. Chairman of the Building Committee, H. E. Mayhew.

Vancouver, B.C.
The Department of Public Works, Ottawa, will call for tenders shortly on the construction of two large sheds on the new wharf. Steel and sheet metal construction, concrete base. Approximate cost, $250,000.

Winnipeg, Man.
In connection with the church being built on River Heights for the Presbyterian Congregation of St. Andrew's, contracts for plumbing, heating and electric work will be let by the general contractors, Grey & Davidson Company, Limited, Wall Street, Winnipeg.

CONTRACTS AWARDED

Belmont, Ont.
The School Board have let the general contract for the erection of a school to Horton Bros., St. Thomas, the contract for heating to Hamilton & Stott, 430 Talbot Street, St. Thomas, and for seating to the Globe Furniture Company, Shantz Avenue, Waterloo. Approximate cost, $7,000.

Compton, Que.
The general contract for the erection of an addition to the Town Hall has been awarded to D. Saultry.

Dartmouth, N.S.
A contract for the installation of fittings at the Post Office has been let to the Office Specialty Manufacturing Company, Sparks Street, Ottawa.

East Angus, Que.
The Department of Public Works, Ottawa, have let the contract for the installation of fittings at the Post Office to the Berlin Interior Hardware Company, 72 Wilmott Street, Berlin, Ont.

Elmira, Ont.
A contract for the construction of septic tanks at St. Paul's Church, Mill St., has been awarded to T. Rudow & Son, Elmira.

Elmwood, Man.
The contract for roofing at the new George V. School has been let to G. A. Glasgow, 532 Agnes Street, Winnipeg.

Fonthill, Ont.
The general contract for rebuilding Holy Trinity Church has been let to F. Grisdale, Thorold, Ont. Architect, D. F. Forbes, Temple Building, Welland. Approximate cost, $4,200.

Kelly's Cross, P.E.I.
The contract for galvanized iron work at St. Joseph's Church has been let to J. E. Wilson Company, Limited, Sydney Street, St. John.

Ottawa, Ont.
The contract for electrical work at Howick Hall, Exhibition Grounds, has been let by the City Council to the Rideau Electric Company, Bank Street.

Quebec, Que.
The roofing contract in connection with the foundling hospital in course of erection on St. Foy Road for the Bon Pasteur Convent has been let to E. Falardeau, Dorchester Street, the contract for plastering to G. A. Vezina, 61 Des Prairies Street, and E. Belanger, and for painting to Gauthier & Bros., 292 St. Joseph Street. Heating, plumbing and electrical work not let.

Romney Township, Ont.
The general contract for the erection of a school in Section No. 6 has been awarded to B. Blonde, 14 Cornhill St., Chatham. Smaller trades will be sublet. Approximate cost, $4,500.

Silver Lake, Ont.
The general contract for the erection of a school has been let by the Trustees of School Section No. 1 to Jenkins & Maurer, Kelso. Approximate cost, $10,000.

St. Albert de Warwick, Que.
Work has been commenced on the erection of a church for the Roman Catholic Congregation by L. Caron, Nicolet. Brick construction. Estimated cost, $18,250.

Victoria, B.C.
In connection with the observatory being built on Little Saanich Mountain for the Department of Public Works, Ottawa, the contract for ornamental iron work has been let to the Grandview Iron Company, 1685 Venables Street, Vancouver, and for electric work to the Hinton Electric Company.

Whitby, Ont.
The Board of Education have let the contract for roofing at the school now in course of erection to the general contractor, J. Pearson, Whitby.

Winnipeg, Man.
In connection with the school being built on Polson Avenue, the contract for heating has been awarded to James Ballantyne Company, Limited, Wall Street.

Wolfville, N.S.
In connection with the students' residence in course of erection at Acadia Collegiate Academy, the contract for roofing, plastering, painting and interior fittings has been awarded to the general contractors, Rhodes Curry Company, Limited, Amherst, the contract for heating and plumbing to Hagee & Company, Amherst, and for electrical work to G. Gormley, Wolfville.

Business Buildings and Industrial Plants

Carlton Point, P.E.I.
Tenders will be received until noon, September 8th, by the Department of Railways and Canals, Ottawa, for the construction of a station, water tank, engine house, transfer platform, standpipe pit and turntable. Plans and specifications with the Engineer, Car Ferry Terminals, the Chief Engineer, Moncton, N.B., and at the Department, Ottawa.

Embro, Ont.
Hugh McDonald, Huron and Commissioner Streets, is about to remodel business premises and install equipment for a general blacksmith shop.

Hensall, Ont.

The erection of an addition to the King George Hotel is being considered by Weir Atcheson. Approximate cost, $5,000.

Lobo, Ont.

Plans are being prepared for a store to be erected for Herman Marsh, Lobo Village, London, Ont., at an estimated cost of $5,000. White brick construction.

McGregor, Ont.

Thomas Imeson is considering the erection of fireproof farm buildings, at an approximate cost of $5,000.

Montreal, Que.

J. E. Desroches, 1621 St. Catherine St. E., is considering the erection of a store and four flats, at an estimated cost of $12,000. Work may be done by contract.

Ottawa, Ont.

W. E. Noffke, Plaza Building, Rideau Street, is preparing plans for an addition to a warehouse and office building on Slater Street for the Bate Realty Company, Slater Street. Concrete block construction, felt and gravel roofing. Approximate cost, $25,000.

Somerset, N.S.

Work will start shortly on the erection of a fruit house for the Somerset Fruit Company. Secretary, F. N. Illsley, Berwick, N.S. Approximate cost, $3,500.

St. John, N.B.

Plans for remodelling the Provincial Bank, Charlotte Street, are being prepared by H. H. Mott, Germain Street. Estimated cost, $12,000.

St. Thomas, Ont.

The St. Thomas Packing Company, Limited, may rebuild a portion of their plant, which was recently destroyed by fire. General Manager, J. Moody.

Toronto, Ont.

J. S. Playter, 176 Danforth Avenue, is building a garage at 184 Danforth Avenue, estimated to cost $3,500. Steel and brick construction, felt and gravel roofing.

The Toronto Hydro Electric Commission, 226 Yonge Street, are having plans prepared for a sub-station to be erected at St. Lawrence Market. Steel and brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $5,000. Work by day labor.

G. W. Vesral, 61 York Street, proposes to erect an addition to his garage at an estimated cost of $4,000. Plans are being prepared by James Loudon & Hertzberg, 79 Adelaide Street E. Brick construction.

Welland, Ont.

Work has been started on the erection of a store and residence at State and Main Streets by Joseph N. Leon. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,500.

Winnipeg, Man.

In our last issue, we inadvertently published details with regard to a building being erected for the Bell Telephone Company of Canada. This information applies to the Bell Telephone Building now in course of erection at Sherbrooke, Que.

CONTRACTS AWARDED

Comber, Ont.

The general and carpentry contracts for the erection of a brick garage for William Keith have been awarded to G. Penie, 149 Lacroix Street, and the masonry contract to Moore & Stephens. Asbestos roofing. Estimated cost, $5,000.

Cornwall, Ont.

Robert Lalonde has let the contract for the erection of stores on Pitt Street to R. E. Ralph, Westboro, Ottawa. Terra cotta hollow tile and red brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $7,000.

Edmonton South, Alta.

The general contract for the erection of a barn in the grounds of the University of Alberta has been let to Frost & Ingraham, 10164 108th Street. Frame construction, concrete foundation, shingle roofing. Estimated cost, $5,000.

Hamilton, Ont.

The Frost Wire Fence Company, Sherman Avenue W., have let the general, masonry, carpentry, steel and roofing contracts for the erection of an addition to their factory to G. E. Mills, King Street E. Brick construction, concrete foundation.

Moncton, N.B.

A permit for the erection of a store has been issued to J. D. Creaghan Company, 795 Main Street. Estimated cost, $3,000.

Montreal, Que.

Work is under way on an addition to grain elevator No. 1, for the Harbour Commissioners. The contract for structural steel has been let to the Dominion Bridge Company, Lachine, the contract for carrying machinery to the Canadian Fairbanks-Morse Company, Limited, 84 St. Antoine Street, and for electrical work to Philip Lahee & Company, 20 St. Nicholas Building.

A. Claude, 196 de L'Epee Avenue, has commenced the erection of a store, estimated to cost $5,000. Contracts for roofing, heating and plumbing have been let to Lavigueur & Menard, 2483 St. Lawrence Boulevard, and for plastering to S. Rochon, 470 Outremont Avenue.

Ottawa, Ont.

The general contract for the erection of an agricultural building at the Government Experimental Farm has been let to W. Ashe, 214 Henderson Avenue, Ottawa.

In connection with the garage in course of erection on Sparks Street for Parks Dye Works, Limited, the contract for electrical work has been let to J. A. Davis, 21 Echo Street. Contracts will be sub-let for plumbing and heating.

Port Arthur, Ont.

The Canadian Northern Railway have let the general contract for the erection of sixteen pens at the stock yards at West Port to the Hearst Engineering Company, Port Arthur. Approximate cost, $10,000. Additional pens will be built later.

Princeville, Que.

Tenders on the erection of a slaughter house for the Co-Operative Abattoir Company will be received until noon, August 28th, by the Secretary, J. S. Picard. Plans and specifications with the Secretary.

Quebec, Que.

In connection with the store and residence being built on Canardiere Street by J. Carmichael, Notre Dame des Laurentides Street, the roofing contract has been let to L. Lajeunesse, 78 St. Agnes Street. Heating and plumbing not let.

Red Deer, Alta.

In connection with the warehouse being built on Gaetz Avenue for Nash Bros., Minneapolis, Minn., the masonry contract has been let to Schnurr Bros., the carpentry contract to the general contractors, Baird & McKenzie, North Red Deer, the contract for heating and plumbing to Smith & Gaetz, 58 Gaetz Avenue N., and for electrical work to the Western General Electric Company, 32 Gaetz Avenue S.

Sherbrooke, Que.

In connection with the office building in course of erection for the Bell Telephone Company of Canada, 118 Notre Dame Street W., Montreal, the carpentry, plastering and interior fittings contracts have been let to the general contractors, Anglins Limited, 65 Victoria Street, Montreal, and the contract for mill work to L. O. Noel, Lennoxville Road, Sherbrooke. Painting not awarded.

Somerset, N.S.

The general contract for the erection of a fruit house for Herbert Ayler, Kentville, has been let to J. H. Hicks & Sons, Bridgetown. Approximate cost, $3,500.

Sydney, N.S.

Work is about to start on the erection of a furniture factory on Charlotte Street for Wrights Limited. The general contract has been awarded to Frank C. Redding, North Sydney, at $25,000. Electric wiring not included.

Toronto, Ont.

T. R. Morris, 182 Bellwoods Avenue, is about to start work on the erection of a store and apartments at Danforth and Langford Avenues, and is receiving tenders on excavation. Masonry and carpentry by day labor. Other trades will be sub-let. Estimated cost, $5,000.

Work is in progress on the construction of a coal and chemical storage plant in connection with the Filtration System at Centre Island. General contractors, W. Cowlin & Son of Canada, Ltd., Mail Building. Approximate cost, $38,000.

Work is in progress on the erection of three stores and apartments on St. Clair Avenue W. for J. R. Gibson, 1228 St. Clair Avenue W. General contractor, J. Crang, 906 St. Clair Avenue W. Approximate cost, $10,000.

Whitby, Ont.

Work has been commenced on the erection of a repair shop and garage for W. J. Luke & Son, Dundas Street. The general, carpentry, steel, roofing, plastering, painting and interior fittings contracts have been let to J. H. James, Brock Street, and the masonry contract to T. G. Deverell, Brock Street. Heating and plumbing not let.

Residences

Blenheim, Ont.

The erection of a residence is contemplated by Thomas Smyth, Communication Road. Approximate cost, $3,500.

Dartmouth, N.S.

Tenders on heating, plumbing and electrical work at a residence being built on

(Continued on page 51)

Tenders and For Sale Department

Paving Tenders

Tenders are called for Reinforced Concrete Paving in the Town of Leamington, 1,840 ft. x 28 ft.; 400 ft. x 42 ft. Plans and specifications with R. M. Selkirk, Town Clerk, Leamington, and J. J. Newman, Engineer, Windsor, Ont. Tenders to be in by September 6th, 1915.

R. M. SELKIRK, Town Clerk,
Leamington, Ont.
34

Extension of Time for Wrecking Buildings

Order No. 1106

Notice is hereby given that the time for receiving tenders for the wrecking of buildings on the St. Paul Street Bridge right-of-way, St. Catharines, Ont., is extended until 5 o'clock p.m. of **Thursday, September 2nd, 1915.**

W. P. NEAR,
City Engineer.
34

THE QUEBEC STREAMS COMMISSION

Proposed Storage Dam on the St. Francis River

Notice to Contractors

Sealed tenders addressed to the undersigned and marked "Tenders for Storage Dam at the outlet of Lake St. Francis," will be received at the Office of The Quebec Streams Commission, Room 264, Parliament Buildings, Quebec, until Twelve o'clock on **Tuesday, the 7th of September next (1915).**

Plans and specifications can be seen on or after this date at the said office or at the Quebec Streams Commission's Office, Room 803, McGill Building, Montreal.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour of the Province of Quebec, which schedule will form part of the contract.

Tenderers are notified that tenders will not be considered unless made strictly in accordance with the printed forms.

An accepted bank cheque for the sum of Fifteen Thousand Dollars ($15,000), made payable to the order of the Provincial Treasurer, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

O. LEFEBVRE,
Chief Engineer.
The Quebec Streams Commission,
Montreal, August 19th, 1915.

Newspapers inserting this advertisement without authority from the Commission will not be paid for it. 34-35

School Tenders

Sealed tenders, including a 5 per cent. marked cheque, will be received up to and including **Monday, August 30th,** by the Secretary of the School Board, Lambton Mills, in whole or in part, for the different trades required in the erection and completion of a school building. Plans and specifications and all particulars can be seen at Molson's Bank, Lambton Mills; also at the offices of the architects. No tender necessarily accepted.

THOMAS ELLIOT,
Sec.-Treasurer School Board,
Lambton Mills, Ont.
ELLIS & ELLIS, Architects,
Manning Chambers, Toronto. 34

To Contractors

Separate sealed tenders accompanied by a marked cheque for 5 per cent. of the amount will be considered at the Township Hall at 4 o'clock p.m., **August 30th,** for the following work in the Township of Logan:—

1. The repairing of the N. W. drain from concession 13 to near the junction of the Grey branch.
2. From concession 10 to the outlet.
3. The repairing of the McNaught drain.

Specifications may be seen at the Clerk's office, lot 16, concession 6. The lowest or any tender not necessarily accepted.

MARVIN LEAKE, Clerk,
R. R. 5, Mitchell, Ont.
August 13, 1915. 33-34

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, August 27, 1915

FOR

All Trades for New Building

Dovercourt School Grounds

Bartlett Avenue

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for 5 per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, **not later than 4 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not be necessarily accepted.

W. C. WILKINSON,
Secretary-Treasurer.

MILES VOKES,
Chairman of Committee.
34

Tenders for Bridge Floor

Order No. 1105

Sealed tenders will be received, addressed to the Chairman of the Bridge Committee, City Buildings, St. Catharines, Ont., up to 5 o'clock of **Thursday, September 2nd, 1915,** for the construction of the Bridge Floor and Sidewalks for the St. Paul Street Bridge, St. Catharines, Ont.

Principal Items of Work

4,400 sq. yds. of Creosoted Wood Block Pavement, including Concrete Foundation.

13,315 sq. ft. of Reinforced Concrete Sidewalks.

Plans and specifications and forms of tender may be obtained at the office of the City Engineer. A certified cheque in the amount of $1,000 payable to the City Treasurer is required to be deposited with the bid and a construction bond of $3,000 shall be furnished the City by the successful tenderer to whom the contract is awarded.

The City reserves the right to reject any or all tenders or to accept the tender which would best serve the interest of the City.

W. P. NEAR,
City Engineer.
34

CITY OF BERLIN

Province of Ontario

Sewage Disposal Works

Sealed tenders will be received by the City Clerk until twelve o'clock noon on

Tuesday, September 7th, 1915

for the construction of Sewage Disposal Works, comprising Tanks, Filters, Sludge Beds and Pumping Station.

Plans and specifications may be seen at the office of the Consulting Engineer, 204 Mail Building, Toronto, also at the City Engineer's Office, Berlin.

The lowest or any tender not necessarily accepted.

HERBERT JOHNSTON, Esq.,
City Engineer.
JOHN HESSENAUER, Esq.,
Chairman Sewerage Committee.
A. H. MILLAR, Esq., City Clerk.
CHIPMAN & POWER,
Consulting Engineers.
34

Fires

Kincardine, Ont.

The pattern shop of the Hunter Bridge & Boiler Company, Queen Street, has been destroyed by fire. Loss, $15,000.

Stoney Beach, Sask.

Fire has destroyed the store belonging to Hugh McGillivray, Pense. Loss on building, $1,200, and on the stock of hardware, $3,000, partially covered by insurance.

Portland Street for W. C. Bishop will be received until September 1st by the Architects, Harris & Horton, Keith Building, Barrington Street, Halifax.

Edmonton South, Alta.

A residence is being built on Fourth Avenue N. E. for Mrs. Catherine See. Work is being done by day labor under supervision of B. A. See. Frame construction, shingle roofing. Approximate cost, $5,000.

Hagersville, Ont.

Plans of a residence are being prepared for Edward Hannah.

Halifax, N.S.

The Eastern Investment Corporation, Cragg Building, Barrington Street, will receive tenders until September 1st on heating, plumbing, electrical work and interior fittings for residences in course of erection on Larch and Jubilee Streets.

Kent Centre, Ont.

Tenders will be received until August 30th on all trades required in the erection of a residence for Thomas Smith. Architect, S. G. Kinsey, Fifth Street, Chatham. Frame construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Millville, N.S.

Work is about to start on the erection of a residence for Amos Hewen. Estimated cost, $3,000.

Montreal, Que.

Work on the erection of a cottage has been started by P. Blais, 462 Old Orchard Street. Estimated cost, $3,500.

J. R. Lavigneur, 273 Visitation Street, has commenced the erection of six flats on Beaudry Street. Estimated cost, $5,000.

Work on the erection of four flats has been commenced by T. Pageau, 337 Stadacona Street. Approximate cost, $7,000.

A. Lafreniere, 2400 Frontenac Street, is building three flats on Frontenac St. at an estimated cost of $3,500.

Ottawa, Ont.

The Oakland Land Company, care of W. J. Spratt, 157 Sunnyside Avenue, are considering the erection of a residence on Bellwoods Street, to cost about $4,500. Double brick veneer construction, stone foundation, shingle roofing.

Samuel Brooks, 69 Union Bank Building, contemplates the erection of a residence, estimated to cost $4,500. Double brick veneer construction, stone foundation, felt and gravel roofing.

Plans have been drawn for a residence to be built on Ossington Street for W. Ryder, 15 Maple Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,800.

Outremont, Que.

The cottages to be erected on Spring Grove Avenue for S. D. Joubert, 336 St. Catherine Road, will be built by day labor. Estimated cost, $17,000.

Port Stanley, Ont.

Oscar Smith, Colborne Street, has commenced the erection of a residence estimated to cost $3,500. Red pressed brick construction, concrete and stone foundation, shingle roofing.

Quebec, Que.

Quotations on all materials required in the erection of a residence are being received by R. Gosselin, 171 First Street, Limoilou.

Work has been started on the erection of a residence by A. Grenier, 74 Third Street. Frame and brick construction, concrete foundation, metal and asbestos roofing. Estimated cost, $3,000.

Work by day labor has been started on the erection of a residence for N. Ferland, 410 St. Francois Street. Brick construction, concrete foundation. Approximate cost, $7,000.

Work by day labor has been started on the erection of a residence on Bougainville Street for Dame Marie R. Anctil, 56 Artillery Street. Brick and frame construction, concrete foundation. Approximate cost, $3,000.

E. Cloutier, 274 Canardiere Road, has commenced the erection of a residence on Tenth Street, Limoilou, estimated to cost $3,000. Work by day labor. Frame and brick construction, concrete foundation.

Renfrew, Ont.

W. E. Noffke, Architect, Plaza Building, Rideau Street, Ottawa, is preparing plans for three double residences to be built here, and will call for tenders shortly. Tile and stucco or brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $10,000. Owner's name withheld.

Ruthven, Ont.

Guy Mills, Lakeshore, Ruthven, has commenced the erection of a residence, estimated to cost $3,000. Frame and white brick construction, concrete and stone foundation, shingle roofing.

Toronto, Ont.

The erection of a pair of residences at 128 Hope Avenue has been commenced by C. A. Drew, 119 Nairn Avenue. Smaller trades will be sub-let. Brick construction, shingle, felt and gravel roofing. Estimated cost, $3,500.

R. J. Marshall, 60 Rosemount Avenue, is building a residence at 7 Glenholme Avenue by day labor. Smaller trades will be sub-let. Brick construction, shingle roofing. Estimated cost, $4,000.

A residence, estimated to cost $4,000, is being built on Kingswood Road by A. Mundy, 43 Columbine Avenue. Brick construction, shingle roofing.

Work has been started by R. C. Naughn & Son, 4 Summerhill Gardens, on the erection of a pair of residences, estimated to cost $8,000. Brick construction, shingle, felt and gravel roofing.

Work on the construction of a brick residence at 1494 Dufferin Street has been started by R. J. Cole, 159 Ellesworth Avenue. Smaller trades will be sub-let. Approximate cost, $3,500.

F. Yetman, 997 Dufferin Street ,is building two residences on Hounslow Heath Road at an estimated cost of $3,800. Brick construction, shingle, felt and gravel roofing. Smaller trades will be sub-let.

Donnenfield Bros., 322 Clinton Street, are erecting three pairs of residences at 43-53 Dixon Avenue. Approximate cost, $15,000.

W. J. McWaters, 28 Kingswood Road, has commenced the erection of a residence on Neville Park Boulevard, estimated to cost $3,500. Smaller trades will be sub-let. Brick construction, shingle roofing.

Work has been started on the erection of a pair of residences at 6-8 Cuthbert Crescent by W. John, 1 Leeds Street. Brick construction, concrete foundation, shingle, felt and gravel roofing. Approximate cost, $6,000. Smaller trades may be sub-let.

W. P. Levack, 519 Roxton Road, is building a residence at 218 High Park Avenue, estimated to cost $4,000. Smaller trades will be sub-let. Brick construction, shingle roofing.

Work has been started by W. P. Levack, 519 Roxton Road, on the erection of a residence at 48 High Park Avenue. Smaller trades will be sub-let. Brick construction, shingle roofing. Approximate cost, $4,000.

A residence is being erected on Aziel Street by Robert McDevitt, 68 Medland Crescent. Brick construction. Estimated cost, $3,000.

Tenders are being received by D. S. Heritage, 43 King Street W., for all trades required in the erection of two residences at Danforth and Greenwood Avenue. Brick construction.

Trenton, Ont.

Frank Felion contemplates the erection of a residence on Queen Street, at an estimated cost of $3,500. Frame and pressed brick construction, concrete foundation, shingle roofing.

Wallaceburg, Ont.

Tenders will be called shortly on the erection of a brick veneer residence for C. M. Yates, Metropolitan Tower, New York. Architect, J. L. Wilson, 64 Market Building, Chatham.

Westboro, Ont.

Tenders will be called shortly on the erection of a residence for Charles Ogilvy, Rideau Street, Ottawa. Plans by W. E. Noffke, Architect, Plaza Building, Rideau Street, Ottawa. Tile and stucco or brick veneer ronstruction, concrete foundation, shingle roofing. Estimated cost, $6,000.

CONTRACTS AWARDED

Barrie, Ont.

The contract for carpentry at the residence being built on Bradford Street by W. C. Thompson has been let to W. Gray, James Street.

The following contracts have been let in connection with the residence being built on Bradford Street by W. C. Thompson: masonry, F. Mayze; cement work, T. Tooke, 30 Grove Street; steel work, roofing and interior fittings, W. Gray, James Street; plastering, Thomas Thompson; painting, W. Barry. Heating, plumbing and electrical work not yet awarded.

Chatham, Ont.

The general contract for the erection of three residences on Hilliard Street for R. F. Mitchell, Fourth Street, has been let to T. Rayment, McKeough Avenue, the plastering contract to C .Wright, Wellington Street E., and the painting contract to W. Palmer, Adelaide Street S. Heating, plumbing, electrical work and interior fittings by owner.

Clinton, Ont.

Prior & Sweet have commenced the erection of a residence for W. J. Elliott, Victoria Street. The contract for carpentry has been let to J. Dayment. Concrete block construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

A residence is being erected for Mrs. Gilchrist, Rattenbury Street, by S. S.

Cooper. Frame and white brick construction, concrete and brick foundation, shingle roofing. Estimated cost, $3,200.

Dundas, Ont.
Work has been started on the erection of a residence on York Street by H. Grobb, 154 Dundurn Street, Hamilton. The masonry contract has been let to George James, and the carpentry contract to Martin H. Hewitt. Tenders on all other trades are now being received.

Halifax, N.S.
In connection with residences and flats in course of erection on Jennings, Jubilee, Lilac, Oxford and Vernon Streets for the Eastern Investment Corporation, Cragg Building, Barrington Street, the heating contracts have been let to Longard Bros., 213 Hollis Street, the plumbing contracts to W. S. Craig, 316 Upper Water Street, and electrical contracts to J. Starr Son & Company, Limited, Granville Street.

Work has been started on the erection of a residence on Pepperel Street for G. A. Cox, 30 Cherry Street. The following contracts have been let:—general, masonry, carpentry, steel, roofing, plastering, painting and interior fittings, G. J. Hilchey, 59 Allen Street; heating, Longard Bros., 213 Hollis Street; plumbing, W. S. Craig, 316 Upper Water Street; Electrical work, Sullifan & Hire, 74½ Gottingen Street.

In connection with the residences built on Louisburg Street for G. A. Cox, 30 Cherry Street, the heating contract has been let to Longard Bros., 213 Hollis Street, the contract for plumbing to W. S. Craig, 316 Upper Water Street, and for electrical work to Sullivan & Haight.

The following contracts hafe been let in connection with the three residences built at South and LeMarchant Streets by the Cranston Building Company, 132 Hollis Street:—heating, Longard Bros., 213 Hollis Street; plumbing, W. S. Craig, 316 Upper Water Street; electrical work, H. Tremaine, 65 Victoria Road.

In connection with the residence in course of erection at 10 Louisburg St. for G. A. Cox, 30 Cherry Street, the following contracts have been let:—general, masonry, carpentry, steel work, roofing, plastering, painting and interior fittings, A. Ferguson, 57 Shirley Street; heating, Longard Bros., 213 Hollis St.; plumbing, W. S. Craig, 316 Upper Water Street; electrical work, Sullivan & Haight.

Hamilton, Ont.
The general, masonry, carpentry and roolng contracts for the erection of a residence on Undermount Avenue for Taylor & Wilson, 100 Locke Street S., have been let to R. G. Wilson, 4 Rutherford Avenue. Brick construction, stone foundation, shingle roofing. Approximate cost, $3,000.

Montreal, Que.
The contract for painting at the residence erected for the Estate of Jonathan Brown, 1050 Dorchester Street W., has been let to the general contractor, A. K. Hutchison, New Birks Building.

F. R. Lanthier, 679 LaSalle Avenue, Maisonneuve, has let the contract for alterations to a residence at 373 Sherbrooke Street E., to A. Chartrand, 611 City Hall Avenue. Approximate cost, $5,000.

Ottawa, Ont.
C. Joyce, 1102 Somerset Street, has let the contract for plastering in connection with the alterations being made to apartments on Somerset Street to L. Lafontine, 503 Cumberland Street.

In connection with the residence built on Woodlawn Avenue for E. G. Brown, Hope Chambers, the contract for plastering and painting has been let to the general contractors, Cuthbertson & Clark, 143 Hawthorn Avenue, and for electrical work to C. C. Gould, 219 Florence Street.

The general contract for alterations and additions to apartments on Slater Street for the H. N. Bate Realty Company, Canal Street, has been awarded to Charles Hopewell, 7 Clemow Avenue. Approximate cost, $6,000.

In connection with the residence being erected on Bethany Street by J. Wilson, Wellington Street, the brickwork contract has been let to C. W. Dean, 21 Stirling Street, the carpentry contract to N. Trudeau, the contract for heating to J. Cameron, 488 Lewis Street, and for plumbing to F. Holt. Plastering and electrical work not let.

Quebec, Que.
The following contracts have been let in connection with the residence erected on the Avenue des Erables for E. Morissette, 208 Latourelle Street:—roofing, E. Falardeau, 308 Queen Street; plastering, A. Frenette, 2 Bourlamarque Street; painting, B. Vaillancourt, 92 Sauvageau Street; heating, plumbing and electrical work, F. Gingras, 34 St. Augustine Street.

The erection of a residence on St. Valier Street has been commenced by L. St. Michel, 199 Ste. Therse Street. Brick and frame construction, concrete foundation, metal and asbestos roofing. Estimated cost, $7,000.

J. E. Boivin, 31 Sixth Avenue, Limoilou, has commenced the erection of a residence on St. Valier Street for N. Alain, 127 St. Luc Street. Brick and frame construction, stone foundation, metal and asbestos roofing. Estimated cost, $5,000.

In connection with the residence built on First Avenue for Damase Belanger, Boilenar Garneau, Domaine Lairet, the roofing contract has been let to O. Barbeau, 154 Franklin Street.

The contract for roofing, plumbing and gas installation at the residence in course of erection for W. Lapointe, 226 Marie de L'Incarnation Street, has been awarded to A. Breton, 235 Kirouac Street, and for plastering to F. Croteau, 21 Chateauguay Street. Painting by day labor.

In connection with the residence being erected on Third Avenue by J. Bornais, 76 Third Avenue, the roofing, plumbing and gas installation contract has been let to A. Breton, 148 Hermine Street. Painting and electrical work not let.

The contract for masonry and carpentry in connection with the residence in course of erection for David Jeon, 159 First Street, Limoilou, has been let to the general contractor, W. Bouchard, 105 Fifth Street, the contract for roofing to N. Barbeau, Bridge Street, and for plumbing and electrical work to J. Vaillancourt, 201 Fleurie Street.

In connection with the residence being built on Canardiere Street for L. Tremblay, 308 St. Joseph Street, the roofing contract has been awarded to L. Lajeunesse, 78 St. Agnes Street. Painting, plumbing and electrical work not let.

E. Belanger, 331 Fourth Avenue, Limoilou, is building a residence estimated to cost $5,000, and has let the contract for roofing, plumbing and electrical work to A. Lapointe, Fourth Street and Sixth Avenue, Limoilou.

N. Jobidon, 110 Fifth Street, Limoilou, has commenced the erection of a residence on Fifth Street for Robert Jobidon. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $8,000.

Ripley, Ont.
The general contract for the erection of a residence for B. Harris has been let to John Robertson. Frame and white brick construction, shingle roofing. Estimated cost, $3,000.

Sarnia, Ont.
A. McColman, 120 Mitton Street N., has commenced the erection of a residence on London Road for W. D. Steadwell, Alexandria Apartments. White brick construction, concrete foundation, shingle roofing. Approximate cost, $7,000.

South Bay, N.S.
The contract for galvanized iron work and roofing at the residence being erected for E. P. Baker has been let to J. E. Wilson Company, Sydney Street, St. John.

St. Lambert, Que.
Work has been started on the erection of a residence for George Bruce by the St. Lambert and District Building Company, Limited, 224 St. James Street, Montreal. The contract for electric wiring has been awarded to C. E. McGregor. Granite, frame and mill construction, shingle roofing. Approximate cost, $4,000.

Thorold, Ont.
Work has been started on the erection of a residence for Frank W. Moore. The contract for masonry has been let to John Porter. Other work by day labor. Approrimate cost, $3,500.

Westmount, Que.
Work has been commenced on the erection of a residence on Westmount Boulevard for Mrs. L. C. Fee. The contract for roofing has been let to Richardson, Simard & Company, 745 Clark St., Montreal, and for electrical work to Mcdonald & Willson Company, Limited, 99 Drummond Street, Montreal.

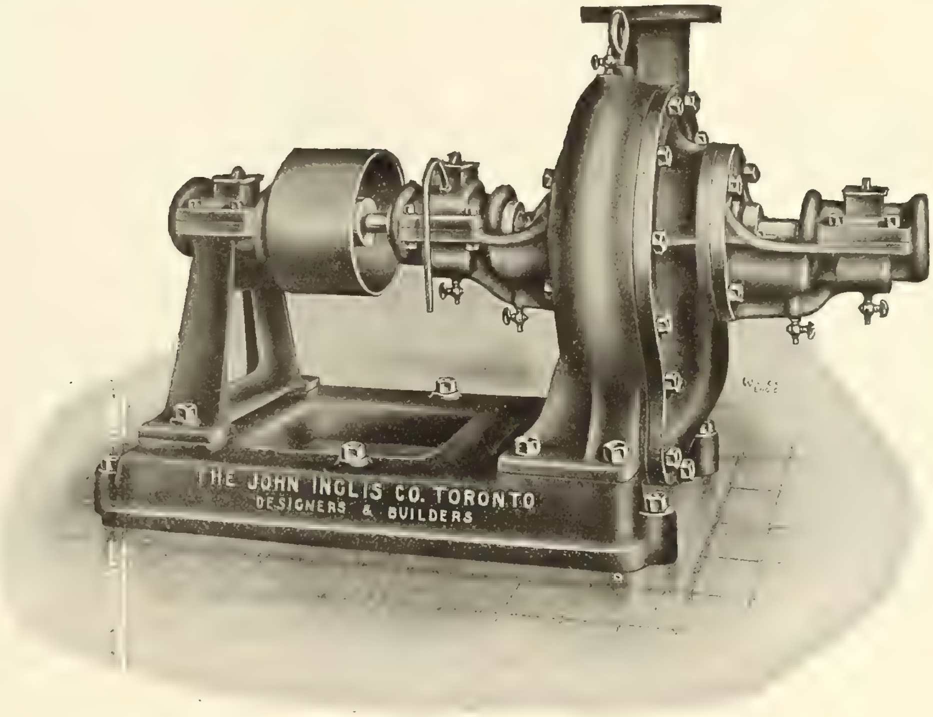
The contract for painting at the residence erected on Edgehill Avenue for C. W. Tinling, 456 MacKay Street, has been let to the general contractor, A. K. Hutchison, New Birks Building.

Power Plants, Electricity and Telephones

Beeton, Ont.
The Town Council contemplate the purchase of boiler and power house equipment. Clerk, Joseph Wright.

Blenheim, Ont.
W. R. Fellows is in the market for electrical supplies.

Toronto, Ont.
The Toronto Hydro Eelectric Commissioners propose to raise $1,375,000 for general extension work, meters, towers, etc.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THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

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14 Strachan Ave., Toronto, Canada

Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Miscellaneous

Fort William, Ont.

Tenders will be received until 4 p.m., August 31st, by R. C. Desrochers, Secretary, Department of Public Works, Ottawa, for dredging in the Kaministiquia River. Plans and specifications at the Department. Specifications only at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Goderich, Ont.

The Doty Engine Company, Limited, Brock Street, are in the market for two turret lathes for shell making.

Ottawa, Ont.

O. A. Letts is in the market for pumps, drills and other equipment for the Russell Natural Gas & Oil Company, 83 Bank Street.

Pelham Township, Ont.

The Chippewa Gas Company are having plans prepared for gas mains to be laid from Cayuga to St. Catharines, and are seeking a charter from the Township Council for this work. Township Clerk, A. N. Armbrust, Ridgeville.

Port Dover, Ont.

Prices, catalogues and other information with regard to brick, fireproofing, hollow tile, steel, metal lath, library fittings, store fronts, canopies, fire escapes, and reinforcing bars are being received by G. Dillon.

St. Catharines, Ont.

Bulk or separate tenders will be received until 5 p.m., September 2nd, by the Chairman of the Finance Committee, for wrecking and removing a number of stores, residences and other buildings on the right-of-way to the St. Paul Street Bridge. An alternative tender will also be received for the salvage of the I. O. O. F. building and lot. Specifications with Engineer W. P. Near.

Toronto, Ont.

The Board of Control will receive tenders until August 31st for the supply and erection of an electric crane, hoist and single line clam shell bucket at the Main Sewage Disposal Works. Plans at office of the Works Department, City Hall.

CONTRACTS AWARDED

Peterborough, Ont.

The contract for the supply of castings until March, 1916, has been awarded by the City Council to G. W. Green Company, Limited, McDonell Street, at $2.25

Late News Items

Bothwell, Ont.

Work is about to start on the erection of a branch building for the Merchants Bank of Canada. The general contract has been let to Reid Bros., Bothwell. Approximate cost, $8,000.

Hensall, Ont.

The erection of a store at an estimated cost of $10,000 is contemplated by Alexander Murdock.

Lachine, Que.

The City Clerk, A. E. Sarra, Bournet, will receive tenders until September 2nd on the erection of the following buildings:—(1) Fire and police station in Ward 1, approximate cost $15,000, Architect, C. R. Tetley, 304 University Street, Montreal; (2) Fire station in Ward 3, approximate cost, $14,000, Architect, Dalbe Viau, 76 St. Gabriel Street, Montreal; (3) Fire station in Ward 4, approximate cost, $18,000, Architects, Benoit & Girard, 128 Bleury Street, Montreal.

Work has been started on the erection of a school and residence on Fifteenth Avenue for the Catholic School Commissioners of Lachine, St. Joseph Street. Carpentry by day labor. Plastering and painting contracts not yet awarded.

London, Ont.

In connection with the school in course of erection at Waterloo and Victoria Streets, the masonry, carpentry, steel, roofing, plastering and painting contracts have been let to the general contractors, J. Hayman & Sons, 432 Wellington St.

Muncey, Ont.

The general contract for the erection of farm and dairy buildings at the Mount Elgin Institute has been let by the Department of Indian Affairs, Ottawa, to A. E. Ponsford, 605 Talbot Street, St. Thomas. Frame and white brick construction, concrete and stone foundation, corrugated iron and shingle roofing. Approximate cost, $27,000.

Ottawa, Ont.

The contract for heating and plumbing at the school built on Daly Avenue for Les Chanoinesses, Cinq Places, 383 Daly Avenue, has been let to E. Claude, 67 Paren Avenue. Other work will be done by the general contractor.

Toronto, Ont.

Quotations are being received by MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto, on the supply of one 1 or 1¼ yards Owens Clam Shell bucket, fitted with teeth and weight, and of one end dump McMyler drag line bucket, 1½ yards.

Water Turbines
Governors
Pumps

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TRADE JOB MARK

is your guarantee.

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Trade goes where it is bidden, and the merchant sells best who advertises best.

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A tarviated road invariably means—
increased property values and lower road taxes.

MODERN engineers recognize that the automobile has come to stay and they build roads accordingly.

Experience has taught them that ordinary macadam cannot resist modern traffic. The rear wheels tear the fine stone loose and the surface blows away in the form of dust.

You have often seen this process of road disintegration, but the probabilities are you never fully realized that a dusty road meant **the road was wasting away.**
The way to build macadam roads today is to use a powerful binder, such as Tarvia, which not only adds greatly to the life of the roadway by making it automobile-proof, but also makes it dustless and mudless.

And of great importance to taxpayers, the reduction in maintenance expenses made possible by this treatment **more than pays for the cost of the Tarvia.**

Thousands of miles of roadway have been treated in this way, because the use of Tarvia means **better** roads at **lower** cost.

Tarvia is made in three grades to meet varying road conditions—"Tarvia X" for new or rebuilt roads and pavements, "Tarvia A" for hot surface applications, and "Tarvia B" for cold surface applications to prevent dust and preserve the road surface.

The illustration above shows the "Tarvia X" construction.

Special Service Department.

This Company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by anyone interested.

If you will write to the nearest office regarding road problems and conditions in your vicinity the matter will have prompt attention.

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MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N. B. HALIFAX, N. S. SYDNEY, N. S.

Steel Derricks
50 Tons Capacity

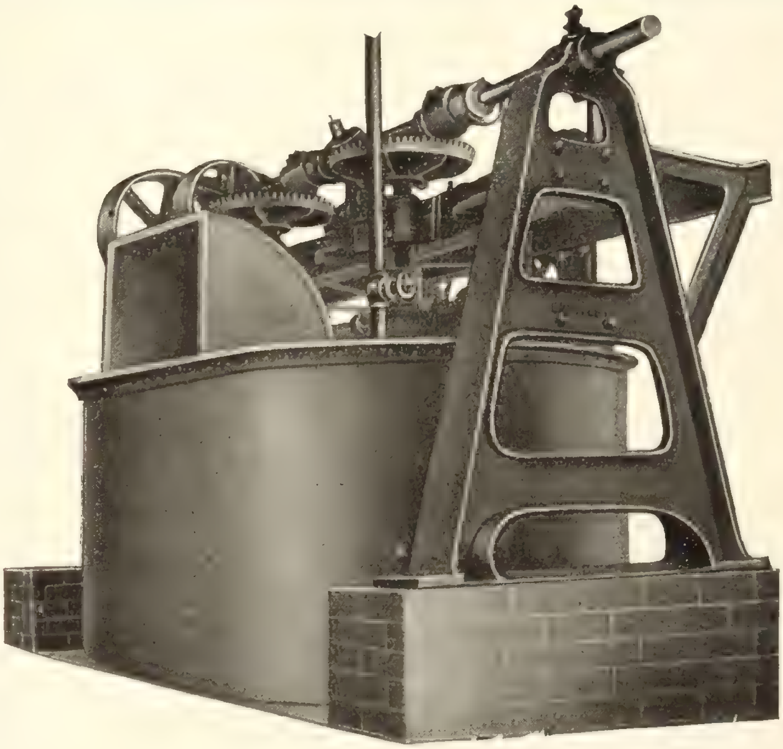
We specialize in the manufacture of steel guy derricks and are prepared to ship this class of derrick in capacities from 5 to 50 tons.

The illustration shows the largest steel guy derrick in Canada. It is our make and "Made in Canada".

Electric Hoists—Cranes—Derrick Irons

Stone and Marble Working Machinery

POLLARD MFG. CO.
LIMITED
Niagara Falls, Canada



The New Improved
Stepless Blunger

Invaluable to manufacturers of tile, terra cotta and electric porcelain, and in all clay working plants where it is desired to mix up clay and other materials into a liquid form for pumping into filter presses. Made in two standard sizes with respective capacities of 2,500 lbs. and 7,000 lbs.

Specially devised arms or beaters raise the lumps and other materials while blunging, and prevent them settling to the bottom of the tank

Modern Machinery for grinding and mixing clay, and for the manufacture of Pottery Electric Porcelain and Tile.

THE CROSSLEY MACHINE CO.
TRENTON, NEW JERSEY, U.S.A.

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They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of costs for special machines to be used as wall hoists, freight or invalid elevators.

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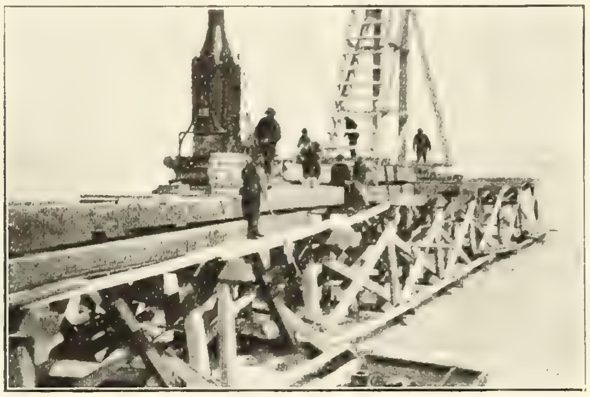
Galt, Ont

MARSH AND HENTHORN
MODERN
HOISTING MACHINERY



M & H Hoisting Engine driving Piles in Harbor at Port Weller, Ont.

Standard Machines in stock. Prompt shipments.
Prices moderate

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and other Structural Steel

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Estimates on application

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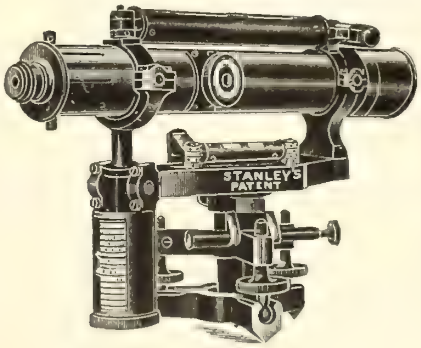

Stanley's Gradiometer saves much time in Railway and Drainage Works. Can be divided to read either ordinary or percentage gradients. Illustrated pamphlet on application.

The Largest Manufacturers of Surveying and Drawing Instruments in the World.

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5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

- Centrally located at Adelaide and Charlotte Streets.
- Light on four sides
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- Vaults
- One block from four car lines
- Floor area 6,300 sq. feet, each floor.

For further particulars ask

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Phone Adelaide 2700

BOOKS

For

Engineers and Contractors

The following Books are Offered subject to Previous Sale:

British & Foreign Building Stones, by John Watson, Published in 1911 at the University Press, Cambridge, England. 483 pages. Price 50 cents.

Building Stone and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons. 414 pages, illustrated. Price $2.00.

Centrifugal Pumps, by R. L. Daugherty. Published in 1915 by McGraw-Hill Book Company. 190 pages, illustrated. Price $2.00.

Construction of Masonry Dams, by Chester W. Smith. Published in 1915 by McGraw-Hill Book Company. 280 pages, illustrated. Price $3.00.

Concrete Stone Manufacture, by Harvey Whipple. Published in 1915 by Concrete-Cement Age Publishing Company. 254 pages, illustrated. Price $1.00.

History of Bridge Engineering, by Henry Grattan Tyrrell, C.E. 480 pages, illustrated. Price $5.00.

Land Drainage, by J. L. Parsons. Published in 1915 by The Myron C. Clark Publishing Company. 165 pages, illustrated. Price $1.50.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1,116 pages, illustrated. Price $1.50.

New Time Savers in Hydraulics and Earthwork, by C. E. Housden. Published in 1914 by Longmans, Green & Company. 50 pages, illustrated. Price 75c.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons. 276 pages, illustrated. Price $1.00.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons. 262 pages. Price 50c.

Some Considerations Regarding Cast Iron and Steel Pipes, by John Sharp. Published in 1914 by Longmans, Green & Company. 142 pages, illustrated. Price $1.50.

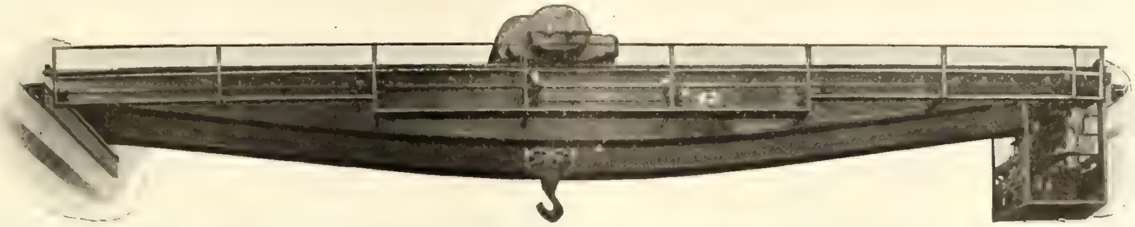
Steel Construction, by Henry Jackson Burt, C. E. Published in 1914 by American Technical Society. 400 pages, illustrated. Price $2.75.

Steel Bridge Designing, by Melville B. Wells, C.E. Published by Myron C. Clark Publishing Company in 1913. 260 pages, illustrated. Price $2.00.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited. 618 pages, illustrated. Price $2.00.

Use of Water in Irrigation, by Samuel Fortier. Published in 1915 by McGraw-Hill Book Company. 265 pages, illustrated. Price $2.00.

Contract Record
347 Adelaide St. West, Toronto, Ont.



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NORTHERN CRANE WORKS, Ltd., Walkerville, Ont.

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HERRINGBONE Copper Alloy Lath, gauge for gauge, will resist hard wall plaster corrosion sixty-one per cent. better than lath made from ordinary steel. In other words, ordinary metal lath would have to weigh sixty-one per cent. more than Herringbone Copper Alloy Lath in order to be equally efficient. This means it would have to cost about fifty per cent. more in order to compete with copper alloy quality.

Yet when Herringbone Metal Lath was changed from ordinary steel to copper alloy the old price to the consumer was not changed. Same price—sixty-one per cent. more quality. At first glance it would appear that the management here lost a great opportunity.

We believe that in adopting this generous policy we have gained, instead of lost, an opportunity. For even before Herringbone lath was made of copper alloy its superior stiffness, salvage edge, and plaster saving qualities made it the standard specification. And now, with this final improvement in quality and the price unchanged, its superiority is absolutely unassailable. Every thinking man will use Herringbone Copper Alloy Lath now.

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MINING PLANTS,
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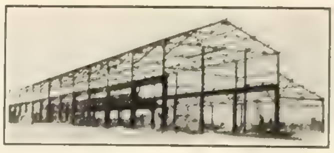

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STRUCTURAL STEEL FOR QUICK DELIVERY

We carry in stock at Montreal 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

Bridges, Roof Trusses, Columns, Girders, Beams, Towers and Tanks, Penstock.

Estimates furnished promptly, Capacity 18,000 Tons Annually.

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Do You Want Crushed Stone ?

That is Clean, Tough Stone of a Quality suitable for Macadam Road and Concrete

We can supply you in any size or quantity.
Our service is unexcelled and our prices right.
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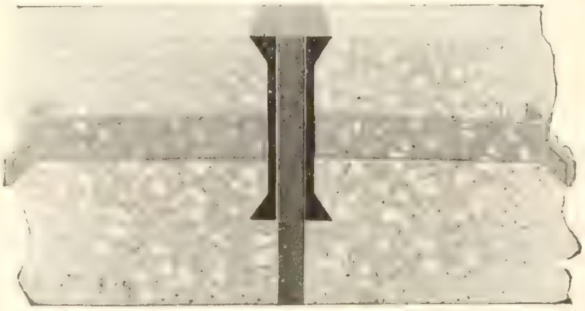
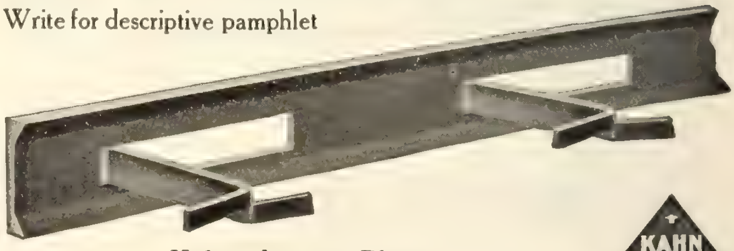
1182 Broadway, New York.

KAHN ARMOR PLATES for CONCRETE ROADS



Cross-sectional view showing joint protected by Kahn Armor Plates with filler between them.

Write for descriptive pamphlet



Kahn Armor Plate.

The Beveled Edge Protects the Concrete

KAHN SYSTEM Building Products

TRUSSED CONCRETE STEEL CO. OF CANADA, LIMITED, Walkerville, Ont.

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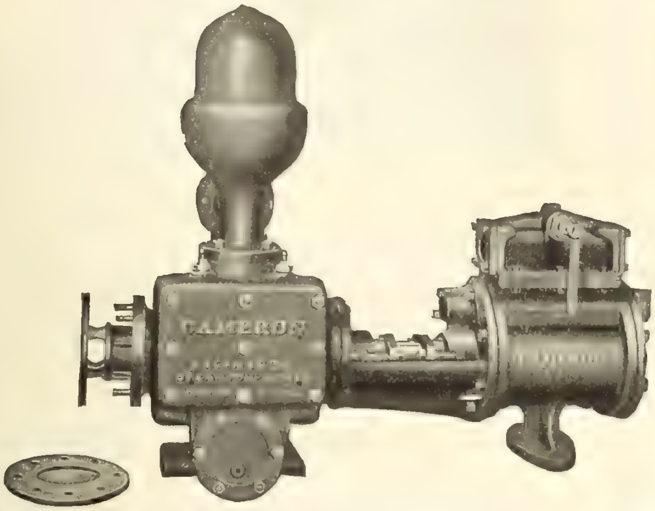

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Removable Bushing Type

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These pumps last a lifetime.

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MONTREAL, - CANADA

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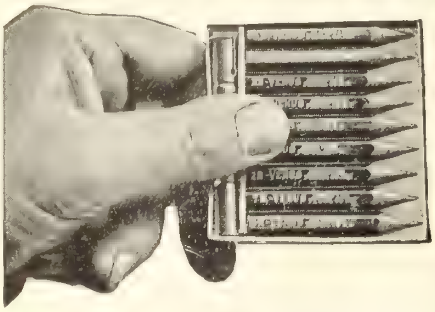

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The designs of our small locomotives are the result of wide experience.

All details are accurately finished to standard gauges and are absolutely interchangeable on all locomotives of the same class and size.

This cuts out long delays when parts wear out, as parts liable to wear can be kept on hand or shipped promptly from our works.

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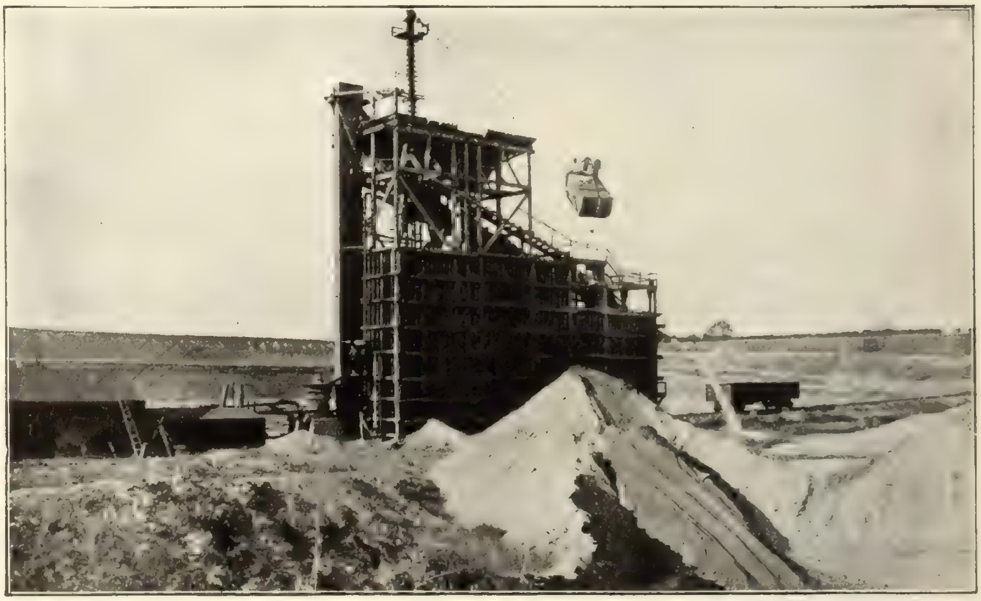
DOMINION EXPRESS BUILDING, MONTREAL, CANADA

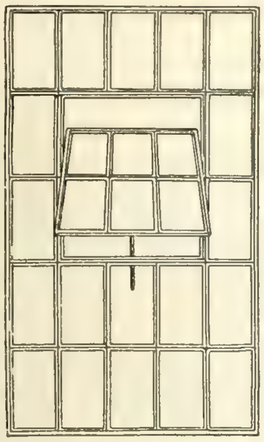
"DULL" Sand and Gravel Plants



"Dull" Sand and Gravel Plants are made to include the operations of obtaining the material and conveying it to the plant for washing and sorting into various sizes. We have had wide experience in designing and erecting hundreds of plants for a variety of uses and under all conditions. The illustration shows a "Dull" plant with sand and gravel being excavated and conveyed to plant by a "Dull" drag line excavator. "Dull" improved conical screens are arranged to make two sizes of sand and two of gravel.

Write us for our illustrated Catalogue.

The Raymond W. Dull Co., 111 Washington St., Chicago
CANADIAN SALES AGENTS
Mills Bros., 215 Ryrie Bldg., TORONTO Bentz-Richardson Co., WINNIPEG



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The Superior Steel Sash

Gives Fire Protection

Lowers Insurance Rates

Can be purchased very little in advance of the price of Wooden Sash.

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A. B. Ormsby Company, Limited
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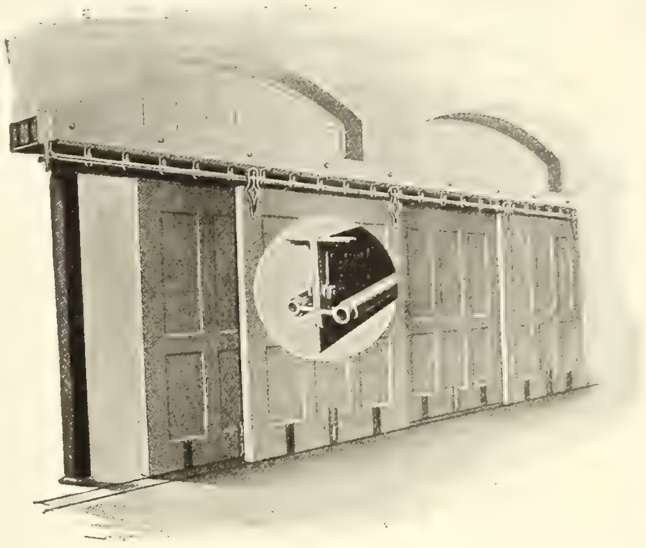

We can supply you with Hangers to carry **any** size door and

Parallel Equipment

in the **strongest style** of track.

The Round Track with **Adjustable Supports.**

Manufacturers of
The best goods in the hanger line

ALLITH MFG. CO., LIMITED
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The opportunity for greater economy and efficiency in **Heating and Ventilating** is emphasized in the **"Keith" Fan.** Comparative tests of other types of fans have resulted in the **"Keith"** being proclaimed the most efficient and economical in the Fan World. Write for our New Catalogue No. 55.

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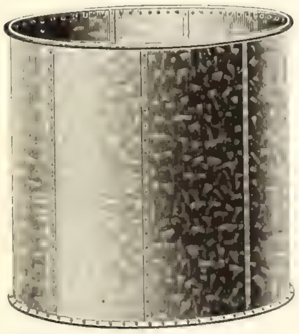

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- **Toat Pans**
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- **Tank and**
- **Measuring Pumps**

Prices quoted promptly on heavy galvanized steel tanks for every purpose.

Wayne Measuring Systems for handling your gasoline and oils will save you money.

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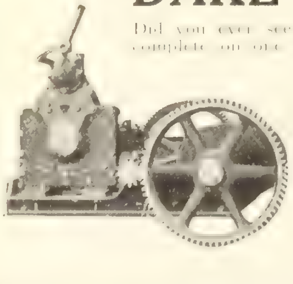
For *Speed* in Derrick Swinging
No Dead Centers
DAKE Swinging Gear



Did you ever see a 7 H. P. engine and swinging gear complete on one compact 42 in. x 46 in. base?
That is the DAKE.
Can be installed in any convenient place near main hoist or can be bolted to the skids in front of your double drum hoist. The swinging drum is low, giving lots of clearance for the hoisting lines.
The compact DAKE square-piston motor, for air or steam, has only two moving parts, and can't stick on a dead center. QUICK ACTING—trouble-proof.
Write for the Dake catalog just out.

DAKE ENGINE CO., Grand Haven, Mich., U.S.A.

Sand, Gravel and Crushed Stone

Lime
Cement
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During the past few months we have supplied ornamental lighting standards for the following places:—

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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

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Towers and Tanks for all purposes.

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every size for Water, Gas, Culvert or Sewer, Carried in Stock at
Lake or Rail Shipments TORONTO and PORT ARTHUR

Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of terrific usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

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Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

"Metallic" Building Materials

Make Money in Bad Weather

Put your men at work erecting "METALLIC" CEILINGS AND WALLS. If you work it right, you can always have a job or two ahead. It's profitable, too—in good weather or bad, if you use Metallic Roofing Company goods. There is many a prospect near you ready for the "Metallic" proposition. We send advertising matter and help you with building plans and suggestions. Write us now.

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We are the largest manufacturers in Canada of both wood and steel Tanks and substructures for factory sprinkler systems and for Municipal

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We shall be pleased to furnish you with all the information and data you may require on this class of work.

Send us your blue prints for estimates.

Send for special Tank and Tower Catalogue

Ontario Wind Engine & Pump Co.
Limited
Toronto Montreal Winnipeg Calgary

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags, $2.25; car lots, $1.50 on the track, with pkgs. $1.90.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, local, $12 to $20, imported, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50, at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND, AND GRAVEL

Toronto prices, F. O. B. Car:

Crushed stone—2-in., $1.05; 1-in., $1.10; ⅜-in., $1.10; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.05 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.05 per cu. yd., f.o.b. C. P. R.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $20; 18 ft., $23; 1-in. Hemlock No. 1 $21; No. 1 Hemlock decking $22 to $23; No. 2 Hemlock, dimension and 1 in., $16 to $18.

Pine—1-in. by 4-in. to 6-in., $27; 1-in. by 8-in., $29; 1-in. by 10-in., $30; 1-in. by 12-in., $30 to $32; 2-in. by 4-in. to 13-in. white pine, 12 ft. to 16 ft. long, $26 to $31; 7/8 by 6 and 10-in. pine shelving, $33 to $36; 7/8 x 12 in. pine shelving, $45; No. 1 white pine flooring, $34; No. 1 spruce flooring, $26; No. 1 pine decking D 2 S, $28; spruce decking, $26; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto, $32; pine trim 4-in. casing, $1.75 per 100 ft.; 5-in. ditto, $2; 8-in. pine base, $2.75 to $3.25; 4-in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.35; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32, retail $37; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel and Iron Bars—$2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $5.35.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Sheets—26 gauge $5.20 per sq., 28 gauge $3.00 to $3.50 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b. factory, 4 in., 25c per ft.; 6 in., 40c ft.; 8-in., 55c ft.; 9 in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40.; 18-in., $1.90 ft.; 20 in., $2.25 ft.; 24-in., $3.25 ft.; less 74 per cent., 4-in to 12-in., 70 per cent., 15-in. to 18-in., 65 per cent., 20-in. to 24-in.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4.50, in car lots at the yard.

Hydrated lime—$9.50 to $11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9.40 per 100 lbs.

Boiled linseed oil—in bbls., 85c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 82c. per gal.; red lead, dry, $8 per 100 lbs.; putty in bulk, bbls., $3.50 per 100 lbs.; in 100-lb. drums, $3.85; putty in 25-lb. tins, $4.00 per 100 lbs.; steel sash putty, $4.00 per 100 lbs.; turpentine, in bls., 68c. per Imp. gal., southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$2.00 steam car load lots, including sacks.

Lime—Hydrated, $12 per ton; lump, $9.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.75; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.20 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $17.75 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $19.25; 60 per cent. at $20.75 f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 containing charge of 8.3 grs., $8.50 per 1,000; No. 6, 15.4 grs., $11.25; No. 7, 23.1 grs., $14.50; No. 8, 30.8 grs., $18.50. Batteries, St'd Rack Bar, "Push Down," No. 2 capacity 10 shots, 15 lbs. net weight, $15.00 each; No. 3, 20 shots, 25 lbs., $22.00; No. 4, 50 shots, 45 lbs., $42.00; No. 5, 100 shots, 53 lbs., $70.00. Leading wire, in coils of 500 ft., 1c. per ft.; leading wire, twin cable, in coils of 250 ft., 3c. per dble. ft.; connecting wire in coils or spools, 50c. per lb. Electric blasting caps, per 100: 4-foot, single strength $3.50, double strength $4.10; 6-foot, single $4.04, double $4.64; 8-foot, single $4.58, double $5.18; 10-foot, single $5.12, double $5.72; 12-foot, single $5.66, double $6.26; 14-foot, single $6.20, double $6.80; 16-foot, single $6.74, double $7.34; 18-foot, single $7.28, double $7.88; 20-foot, single $7.82, double $8.42; 22-foot, single $8.57, double $9.17; 24-foot, single $9.32, double $9.92; 26-foot, single $10.07, double $10.67; 28-foot, single $10.82, double $11.42; 30-foot, single $11.57, double $12.17.

STEEL AND IRON

Steel angles—3 in. x 3 in. and up, $2.75; 1 in. x 1 in. x ⅛ in., 25c. extra; ¾ in. x¾ in. x ⅛ in. 50c. extra. Boiler plates—¼ in. thick and thicker, $2.20. Circular plates—Flange quality, 30 in. dimensions and over, $2.45; under 30 in. dimensions, $2.65. Beams and channels—Under 35 lbs. per yd., $3.00; 35 lbs. per yd. and over, $2.85, f.o.b. Montreal, net cash. Corrugated iron—26 gauge, $3.85; 28 gauge, $3.50 per sq. net cash. Copper bearing sheets—Keystone black, 28 U. S. gauge, $3.15 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 10c; 10-in., 80c; 12-in., $1; **24-in., $3.25. Bends, each, 75c, $1.20; $2.20,** $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.) Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.0, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13½c basis; African hemp, 13½c.; sisal rope, 11½c. basis; lath yarn, 10¾c. Boiled linseed oil—in barrels, 72½c. per gal. of 9 lbs. Raw linseed oil—in barrels, 70c. per gal.

WINNIPEG PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20. Bags 10 cents extra.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND, AND GRAVEL

Crushed Stone—2-in., $2.50 per yd.; 1-in., $2.75; ¼-in., $2.75; stone dust, $2.25; rubble stone, car load lots, delivered, $13 per cord. Del. south of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¼-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft. 5¼-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 68)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY

LIMITED

BAR STEEL

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THE
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COMPANY LIMITED
SYDNEY, N.S
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Gypsum Products

"Pillar Brand"

Hardwall Plaster, Cement Plaster, Land Plaster
Whitewall Finish, Plaster of Paris

"Pillar Brand" Gypsum Products are calcined and prepared by expert workmen under experienced supervision. The material used is the best grade of pure Nova Scotia rock. Our facilities for handling crushed gypsum are unexcelled. Shipments by rail or water.

Write Us.

The Iona Gypsum Co., Limited

Head Office, Sydney, N. S. ***Mills,*** Iona, N. S.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page (66)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 9 in., 35 cents; 10 in., 40 cents; 12 in., 50 cents; 15 in., 75 cents; 18 in., $1.00; 20 in., $1.50; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl., in bags $15.00.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $11.50 per 100 lbs.; boiled linseed oil, in bbls., 98 cents per gal.; raw linseed oil, in bbls., 95 cents per gal.; dry red lead, $10.00 per 100 lbs.; putty in bulk, $3.25 per bbl.; putty in 25-lb. tins, $3.75; turpentine, in bbls., 80 cents per gal. Mixed paint, ordinary colors, per gal., $3.10.

VANCOUVER PRICES

CEMENT, LIME, AND BRICK

Cement—Grey Portland, $2.35 per bbl. f.o.b. warehouse, sacks extra; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 per bbl.; white Portland cement, $7.50 per bbl. of 350 lbs., sacks 10c. extra, f.o.b. Vancouver.

Lime—$1.35 per bbl f.o.b. warehouse or delivered.

Brick (Common red brick, $9 to $11 f.o.b. warehouse. $9 to $11 in car lots f.o.b. Vancouver; pressed red brick, $30 f.o.b. wharf Vancouver; pressed buc brick $40 at warehouse; $33 in car lots; tapestry brick, $45 at warehouse; impervious brick, $45 f.o.b. buildings; fire brick, $35 in car lots, $40 in warehouse; fire clay, $12 per ton in car lots.

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Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

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STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.75 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galavanized iron—28 gauge, $5.75 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.45, 9 and 10 ft. sheets, $4.60 per square. Black steel sheets, 24 gauge, $3.40 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 12½c. per ft.; 6-in., 21c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in, 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in,, $1.50 ft.; 24-in., $2.25 (all net prices).

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Hard wall plaster—$13.00 in car lots f.o.b. Vancouver, bags extra.

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Plaster of Paris—Hammer brand, $4 per bbl.

Finishing Plaster—$15 per ton, sacks extra.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 16c. basis; 2nd grade, 14½c. basis; sisal rope, 12¼c. basis.

PAINTS AND OILS

Mixed paint—per gal., $2.75 to $3.25.

White lead—ground in oil, $11.50 to $12.50 per 100 lbs.

Boiled linseed oil—in bbls., $1.25 per gal. of 9 lbs.

Raw linseed oil—in bbls., $1.25 per gal.; red lead, dry, $10 to $11 per 100 lbs.; putty in bulk, bbls. 3c.; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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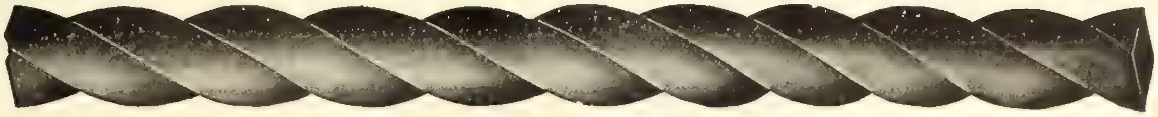

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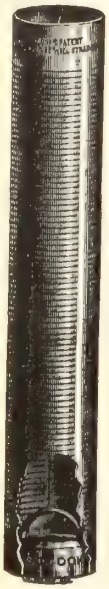

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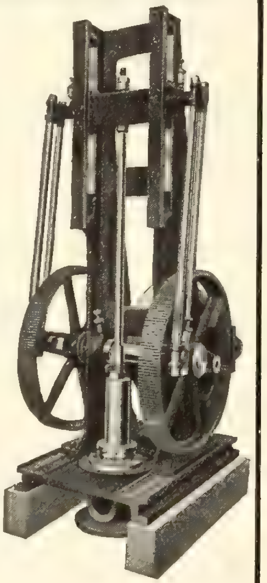

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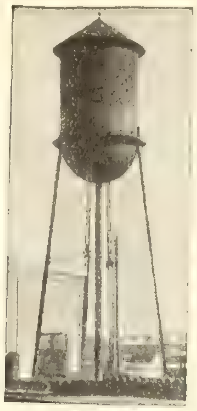

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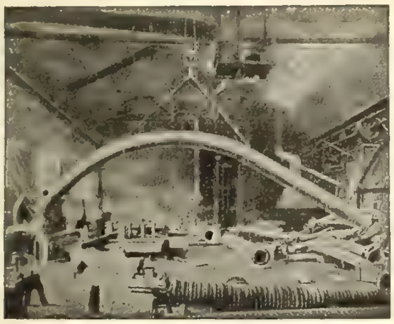

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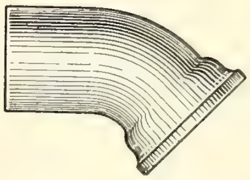

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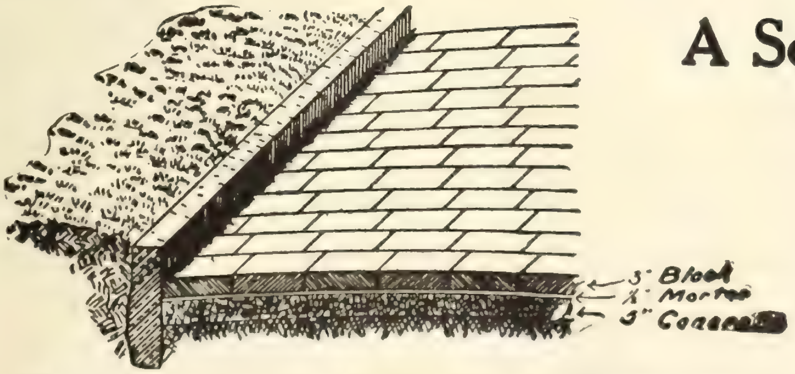

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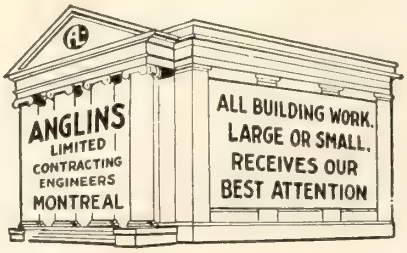
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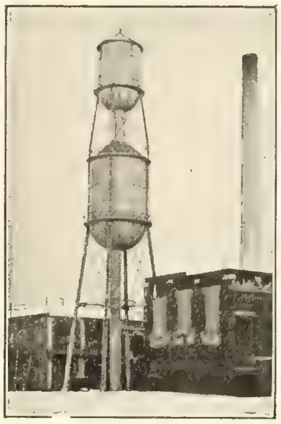

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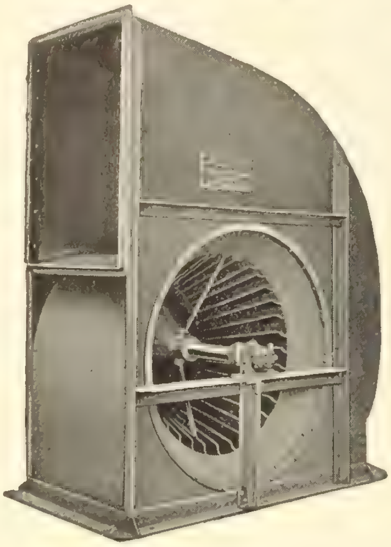

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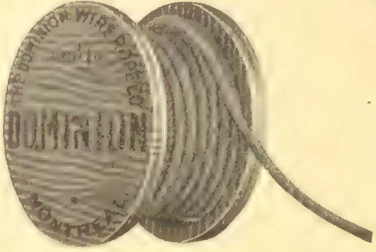

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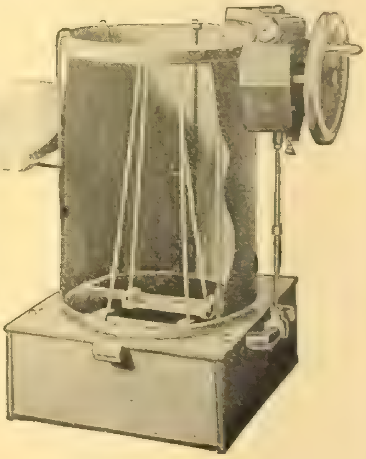

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